# Stormwater Impact Analysis and Final Design of SCM

The Point / AWH-20000 / August 2021

McAdams

# THE POINT

## PACKAGE 2

*ROLESVILLE, NORTH CAROLINA*

# STORMWATER IMPACT ANALYSIS AND FINAL DESIGN OF SCM

## CONSTRUCTION DRAWINGS
*PLANNING #: SUP 18-09*

| | |
|---|---|
| PROJECT NUMBER: | AWH-20000 |
| DESIGNED BY: | DANIEL WIEBKE, PE, CFM |
| | TOMMY DABOLT |
| DATE: | AUGUST, 2021 |

**McADAMS**

2905 MERIDIAN PARKWAY
DURHAM, NORTH CAROLINA 27713
NC LIC. # C-0293

# THE POINT
*Stormwater Impact Analysis-CD Package 2*

## GENERAL DESCRIPTION

The Point is a proposed residential development in Rolesville, North Carolina, located between Highway 401 and East Young Street/Rolesville Road. The development is approximately 300 acres, divided into a northern parcel (to be developed at a later date) and a southern parcel. This Stormwater Impact Analysis covers the development of the southern parcel only. The development will consist of approximately 804 lots, a mixture of townhomes and various types of single-family housing, thirteen stormwater control measures, sidewalks, roadways, greenway trail, and associated infrastructure. At this time stormwater control measures have been developed to a construction level for a portion of the site referred to as CD Package 2. This package includes 5 stormwater control measures; SCM B, G, H, I and J. CD Package 1 ponds are included in the analysis as well to account for a fully developed CD Package 1 prior to CD Package 2 construction.

The project site is located in the Neuse River Basin, and drains to Harris Creek (Peeples Creek / Wake Crossroads Lake) (BIMS # 27-26) and is classified as C;NSW. Per Town of Rolesville regulations, stormwater management on this site shall meet the stormwater management performance standards for development set forth in the Rolesville Unified Development Ordinance Article 7, Section 7.5.4 – Standards.

The regulations are as follows:

(B) Standards Based on Project Density

(4) **Development Standards for High-Density Projects** High-Density Projects shall implement stormwater control measures that comply with each of the following standards, in addition to the General Standards found in subsection B of this Section:

(a) The measures shall control and treat runoff from the first inch of rain. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours.

(b) All structural stormwater treatment systems used to meet these requirements shall be designed to have a minimum of 85 percent average annual removal for Total Suspended Solids (TSS).

(c) All Development and Redevelopment projects required to manage storm water shall provide permanent on-site BMPs to lower the nitrogen export amounts as part of the storm water management plan. BMPs are to be in accordance with and as specified in the Design Manual.

(d) Structural and Non-structural BMPs shall be used to ensure there is no net increase in peak flow leaving the site from the pre-Development conditions for the one-year, 24-hour storm. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours.

(e) General engineering design criteria for all projects shall be in accordance with 15A NCAC 2H .1008(c), as explained in the Design Manual;

(f) All Development and Redevelopment shall be located outside the Riparian Buffer Zone and the Flood Protection Zone. These Zones shall be in accordance with the following provisions:

i. Except where other applicable buffer standards are more restrictive, the Riparian Buffer Zone shall extend a minimum of 50 feet landward of all Perennial and Intermittent Surface Waters. The most restrictive standards shall apply.

ii. The Riparian Buffer Zone shall remain undisturbed unless otherwise permitted by this section.

iii. The Flood Protection Zone shall extend throughout the FEMA 100-year floodplain as identified on the current Flood Insurance Rate Map (FIRM) published by FEMA. The Flood Protection Zone shall remain undisturbed unless otherwise permitted by this section.

iv. No Development or Redevelopment is permitted within the Riparian Buffer Zone or the Flood Protection Zone except for stream bank or shoreline restoration or stabilization, water dependent structures, and public or private projects such as road crossings and installations, utility crossings and installations, and greenways, where no practical alternatives exist.

v. Permitted activities within the Riparian Buffer Zone and the Flood Protection Zone shall minimize impervious coverage, direct runoff away from surface waters to achieve diffuse flow, and maximize the utilization of Non-structural BMPs.

vi. Where the Riparian Buffer Zone and the Flood Protection Zone both are present adjacent to surface waters, the more restrictive shall apply.

(g) The approval of the stormwater permit shall require an enforceable restriction on property usage that runs with the land, such as recorded deed restrictions or protective covenants, to ensure that future Development and Redevelopment maintains the site consistent with the approved project plans. Buffer widths and locations shall be clearly delineated on all plans, final plat, and as-builts.

## (B) General Standards

(1) **Downstream Impact Analysis** The downstream impact analysis must be performed in accordance with the "ten percent rule," and a copy of the analysis must be provided with the permit application. The purpose of the downstream impact analysis is to determine if the project will cause any impacts on flooding or channel degradation downstream of the project site. The analysis must include the assumptions, results and supporting calculations to show safe passage of post-Development design flows downstream. This analysis shall be performed at the outlet(s) of the site, and downstream at each tributary junction to the point(s) in the conveyance system where the area of the portion of the site draining into the system is less than or equal to ten percent of the total drainage area above that point.

(2) **Standards for Stormwater Control Measures**

(a) **Evaluation According to Contents of Design Manual** All stormwater control measures and stormwater treatment practices (or BMPs) required under this ordinance shall be evaluated by the Stormwater Administrator according to the policies, criteria, and information, including technical specifications and standards and the specific design criteria for each stormwater practice, in the Design Manual. The Stormwater Administrator shall determine whether proposed BMPs will be adequate to meet the requirements of this ordinance.

(b) **Determination of Adequacy; Presumptions and Alternatives** Stormwater treatment practices that are designed, constructed, and maintained in accordance with the criteria and specifications in the Design Manual will be presumed to meet the minimum water quality and quantity performance standards of this ordinance. Whenever an applicant proposes to utilize a practice or practices not designed and constructed in accordance with the criteria and specifications in the Design Manual, the applicant shall have the burden of demonstrating that the practice(s) will satisfy the minimum water quality and quantity performance standards of this ordinance. The Stormwater Administrator may require the applicant to provide the documentation, calculations, and examples necessary for the Stormwater Administrator to determine whether such an affirmative showing is made.

(c) **Separation from Seasonal High Water Table** For BMPs that require a separation from the seasonal high-water table, the separation shall be provided by at least 12 inches of naturally occurring soil above the seasonal high-water table.

## CALCULATION METHODOLOGY

- Areas outside of the Package 1 area have been assumed to be undeveloped for the purposes of this analysis.
- Rainfall data for this area in the Rolesville, NC region is from NOAA Atlas 14. This data contains a depth-duration-frequency (DDF) table describing rainfall depth versus time for varying return periods in the area. These rainfall

depths are input into the meteorological model within PondPack for peak flow rate calculations. Please reference the precipitation information within the Miscellaneous Site Information section of this report for additional information.

- On-site and off-site soils were determined using best available GIS data sources.

- Soil Conservation Service Curve Numbers (SCS CN) were selected from Table 2 of the USDA TR-55 for the land use that is most similar to the zoning type or cover condition.

- Land cover conditions for the pre-development condition were taken from survey provided by WithersRavenel and aerial imagery for the site. Land cover conditions for the post-development condition were taken from the proposed layout. Offsite cover conditions were based on GIS-based zoning mapping, provided by the Town of Rolesville.

- The time of concentration was calculated using SCS TR-55 (Segmental Approach, 1986). The Tc flow path can be divided into three segments: overland flow, concentrated flow, and channel flow. The travel time was then computed for each segment, from which the overall time of concentration was determined by taking the sum of each segmental time.

- Existing topographic information used in this analysis is from survey provided by WithersRavenel and QL2 LiDAR from North Carolina's Spatial Data Download.

- PondPack Version V8i was used in determining the pre- & post-development peak flow rates for the 1- and 10-year storm events, as well as routing calculations for the proposed stormwater control measures.

- For 100-year storm routing calculations, a "worst-case" condition was modeled in order to ensure the proposed facility would safely pass the 100-year storm event. The assumptions used in this scenario are as follows:

  - The starting water surface elevation in the facility, just prior to the 100-year storm event, is at the invert of the secondary orifice. This scenario could occur as a result of a clogged primary orifice or a rainfall event that lingers for several days. This could also occur as a result of several rainfall events in a series, before the low-flow orifice has an opportunity to draw down the storage pool.

  - Approximately 1-foot of freeboard is provided between the peak elevation during the "worst-case" scenario and the top of the dam for the proposed facility.

To meet the above Town of Rolesville standards, thirteen stormwater control measures (SCMs) have been proposed.

## DISCUSSION OF RESULTS

### PEAK RUNOFF CONTROL REQUIREMENTS
As shown in the Summary of Results section of this SIA, the proposed stormwater control measures provide the necessary peak runoff control for the proposed build-out condition of the development such that there are no calculated increases in the 1- and 10-year storm events at any point of analysis leaving the site.

### POLLUTANT AND NUTRIENT CONTROL REQUIREMENTS
The proposed SCM is designed to the Minimum Design Criteria of the NCDEQ Stormwater Design Manual. Therefore, the proposed development is treated for 85% TSS removal and provides nitrogen and phosphorus treatment.

**CONCLUSION**

If the development on this tract is built as proposed within this report, then the requirements set forth in Town of Rolesville regulations will be met without additional stormwater management facilities. However, modifications to the proposed development may require that this analysis be revised. Some modifications that would **require** this analysis to be revised include:

1. The proposed site impervious surface exceeds the amount accounted for in this report.
2. The post-development watershed breaks change significantly from those used to prepare this report.

The above modifications may result in the assumptions within this report becoming invalid. The computations within this report will need to be revisited if any of the above conditions become apparent as development of the proposed site moves forward.

*SUMMARY OF RESULTS*

**SUMMARY OF RESULTS**

**RELEASE RATE MANAGEMENT RESULTS**

| POINT OF ANALYSIS #1 | | | |
|---|---|---|---|
| Return Period | Pre-Dev [cfs] | Post-Dev [cfs] | % Increase [%] |
| 1-Year | 283.5 | 227.0 | -20% |
| 10-Year | 545.3 | 521.3 | -4% |

| POINT OF ANALYSIS #2 | | | |
|---|---|---|---|
| Return Period | Pre-Dev [cfs] | Post-Dev [cfs] | % Increase [%] |
| 1-Year | 77.3 | 70.4 | -9% |
| 10-Year | 153.0 | 139.4 | -9% |

| POINT OF ANALYSIS #3 | | | |
|---|---|---|---|
| Return Period | Pre-Dev [cfs] | Post-Dev [cfs] | % Increase [%] |
| 1-Year | 8.2 | 6.0 | -26% |
| 10-Year | 21.2 | 15.1 | -29% |

| POINT OF ANALYSIS #4 | | | |
|---|---|---|---|
| Return Period | Pre-Dev [cfs] | Post-Dev [cfs] | % Increase [%] |
| 1-Year | 344.2 | 289.2 | -16% |
| 10-Year | 704.1 | 675.0 | -4% |

| POINT OF ANALYSIS #5 | | | |
|---|---|---|---|
| Return Period | Pre-Dev [cfs] | Post-Dev [cfs] | % Increase [%] |
| 1-Year | 359.7 | 353.5 | -2% |
| 10-Year | 787.2 | 787.1 | 0% |

**SUMMARY OF RESULTS**

## STORMWATER CONTROL MEASURE 'B'  SUMMARY

| | | |
|---|---|---|
| Design Drainage Area = | 10.26 | ac |
| Design Impervious Area = | 6.11 | ac |
| % Impervious = | 59.6% | |
| | | |
| Top of Dam = | 382.00 | ft |
| NWSE = | 376.00 | ft |
| WQv Ponding Elevation = | 377.86 | ft |
| | | |
| Required Main Pool Surface Area at NWSE = | 6,766 | sf |
| Total Surface Area Provided at NWSE = | 9,314 | sf |
| Provided Main Pool Surface Area at NWSE = | 6,928 | sf |
| | | |
| WQv Orifice Diameter = | 2.00 | in |
| WQv Orifice Invert Elevation = | 376.00 | ft |
| | | |
| Riser Size = | 4' x 4' | |
| Riser Crest = | 380.00 | ft |
| | | |
| Number of Orifices = | 3 | |
| Orifice Invert Elevation = | 379.00 | ft |
| Orifice Width = | 36.00 | in |
| Orifice Height = | 6.00 | in |
| | | |
| Barrel Diameter = | 24 | in |
| # of Barrels = | 1 | |
| Upstream Invert = | 375.00 | ft |
| Downstream Invert = | 374.00 | ft |
| Length = | 50 | ft |
| Slope = | 0.0200 | ft/ft |

## STORMWATER CONTROL MEASURE 'B' ROUTING RESULTS

| Return Period | Inflow [cfs] | Outflow [cfs] | Max. WSE [ft] |
|---|---|---|---|
| 1-Year | 29.9 | 1.6 | 379.07 |
| 10-Year | 55.8 | 22.5 | 380.12 |
| 25-Year | 64.7 | 31.5 | 380.57 |
| 100-Year | 77.5 | 34.7 | 381.19 |

| Freeboard |
| --- |
| [ft] |
| 2.93 |
| 1.88 |
| 1.43 |
| 0.81 |

**STORMWATER CONTROL MEASURE 'G'  SUMMARY**

| | | |
|---|---|---|
| Design Drainage Area = | 13.66 | ac |
| Design Impervious Area = | 8.16 | ac |
| % Impervious = | 59.8% | |
| | | |
| Top of Dam = | 346.00 | ft |
| NWSE = | 340.00 | ft |
| WQv Ponding Elevation = | 341.58 | ft |
| | | |
| Required Main Pool Surface Area at NWSE = | 11,552 | sf |
| Total Surface Area Provided at NWSE = | 15,673 | sf |
| Provided Main Pool Surface Area at NWSE = | 12,421 | sf |
| | | |
| WQv Orifice Diameter = | 2.50 | in |
| WQv Orifice Invert Elevation = | 340.00 | ft |
| | | |
| Riser Size = | 5' x 5' | |
| Riser Crest = | 345.00 | ft |
| | | |
| Number of Weirs = | 3 | |
| Weir Length = | 48.00 | in |
| Orifice Invert El. = | 343.75 | ft |
| | | |
| Barrel Diameter = | 36 | in |
| # of Barrels = | 1 | |
| Upstream Invert = | 339.50 | ft |
| Downstream Invert = | 339.00 | ft |
| Length = | 48.5 | ft |
| Slope = | 0.0103 | ft/ft |

**STORMWATER CONTROL MEASURE 'G' ROUTING RESULTS**

| Return Period | Inflow [cfs] | Outflow [cfs] | Max. WSE [ft] |
|---|---|---|---|
| 1-Year | 45.5 | 0.4 | 343.67 |
| 10-Year | 79.4 | 20.3 | 344.42 |
| 25-Year | 90.8 | 40.9 | 344.83 |
| 100-Year | 107.2 | 62.7 | 345.33 |

| Freeboard |
| --- |
| [ft] |
| 2.33 |
| 1.58 |
| 1.17 |
| 0.67 |

# SUMMARY OF RESULTS

## STORMWATER CONTROL MEASURE 'H'  SUMMARY

| | | |
|---|---|---|
| Design Drainage Area = | 16.40 | ac |
| Design Impervious Area = | 9.15 | ac |
| % Impervious = | 55.8% | |
| Top of Dam = | 336.00 | ft |
| NWSE = | 330.00 | ft |
| WQv Ponding Elevation = | 331.54 | ft |
| Required Main Pool Surface Area at NWSE = | 13,269 | sf |
| Total Surface Area Provided at NWSE = | 18,403 | sf |
| Provided Main Pool Surface Area at NWSE = | 14,123 | sf |
| WQv Orifice Diameter = | 2.75 | in |
| WQv Orifice Invert Elevation = | 330.00 | ft |
| Riser Size = | 6' x 6' | |
| Riser Crest = | 335.00 | ft |
| Number of Orifices = | 3 | |
| Orifice Invert Elevation = | 333.75 | ft |
| Orifice Width = | 60.00 | in |
| Orifice Height = | 6.00 | in |
| Barrel Diameter = | 42 | in |
| # of Barrels = | 1 | |
| Upstream Invert = | 329.50 | ft |
| Downstream Invert = | 327.00 | ft |
| Length = | 200 | ft |
| Slope = | 0.0125 | ft/ft |

## STORMWATER CONTROL MEASURE 'H' ROUTING RESULTS

| Return Period | Inflow [cfs] | Outflow [cfs] | Max. WSE [ft] |
|---|---|---|---|
| 1-Year | 52.3 | 0.4 | 333.74 |
| 10-Year | 93.4 | 23.5 | 334.41 |
| 25-Year | 107.2 | 36.1 | 334.98 |
| 100-Year | 127.2 | 71.8 | 335.54 |

| Freeboard |
| --- |
| [ft] |
| 2.26 |
| 1.59 |
| 1.02 |
| 0.46 |

**STORMWATER CONTROL MEASURE 'I'  SUMMARY**

| | | |
|---|---|---|
| Design Drainage Area = | 8.37 | ac |
| Design Impervious Area = | 4.54 | ac |
| % Impervious = | 54.3% | |
| | | |
| Top of Dam = | 324.00 | ft |
| NWSE = | 318.00 | ft |
| WQv Ponding Elevation = | 319.67 | ft |
| | | |
| Required Main Pool Surface Area at NWSE = | 5,024 | sf |
| Total Surface Area Provided at NWSE = | 7,619 | sf |
| Provided Main Pool Surface Area at NWSE = | 5,157 | sf |
| | | |
| WQv Orifice Diameter = | 1.75 | in |
| WQv Orifice Invert Elevation = | 318.00 | ft |
| | | |
| Riser Size = | 5' x 5' | |
| Riser Crest = | 323.00 | ft |
| | | |
| Number of Orifices = | 3 | |
| Orifice Invert Elevation = | 322.00 | ft |
| Orifice Width = | 48.00 | in |
| Orifice Height = | 9.00 | in |
| | | |
| Barrel Diameter = | 36 | in |
| # of Barrels = | 1 | |
| Upstream Invert = | 317.00 | ft |
| Downstream Invert = | 316.00 | ft |
| Length = | 48.5 | ft |
| Slope = | 0.0206 | ft/ft |

**STORMWATER CONTROL MEASURE 'I' ROUTING RESULTS**

| Return Period | Inflow [cfs] | Outflow [cfs] | Max. WSE [ft] |
|---|---|---|---|
| 1-Year | 24.4 | 0.2 | 321.73 |
| 10-Year | 45.5 | 15.2 | 322.43 |
| 25-Year | 52.8 | 28.6 | 322.81 |
| 100-Year | 63.2 | 45.9 | 323.22 |

| Freeboard |
| --- |
| [ft] |
| 2.27 |
| 1.57 |
| 1.19 |
| 0.78 |

**SUMMARY OF RESULTS**

**STORMWATER CONTROL MEASURE 'J'  SUMMARY**

| | | |
|---|---|---|
| Design Drainage Area = | 14.19 | ac |
| Design Impervious Area = | 6.69 | ac |
| % Impervious = | 47.2% | |
| | | |
| Top of Dam = | 316.00 | ft |
| NWSE = | 310.00 | ft |
| WQv Ponding Elevation = | 311.65 | ft |
| | | |
| Required Main Pool Surface Area at NWSE = | 8,495 | sf |
| Total Surface Area Provided at NWSE = | 11,895 | sf |
| Provided Main Pool Surface Area at NWSE = | 8,977 | sf |
| | | |
| WQv Orifice Diameter = | 2.25 | in |
| WQv Orifice Invert Elevation = | 310.00 | ft |
| | | |
| Riser Size = | 5' x 5' | |
| Riser Crest = | 314.00 | ft |
| | | |
| Number of Orifices = | 1 | |
| Orifice width = | 48.00 | in |
| Orifice height = | 6.00 | in |
| Orifice Invert El. = | 313.00 | ft |
| | | |
| Barrel Diameter = | 36 | in |
| # of Barrels = | 1 | |
| Upstream Invert = | 309.50 | ft |
| Downstream Invert = | 309.00 | ft |
| Length = | 48.5 | ft |
| Slope = | 0.0103 | ft/ft |

**STORMWATER CONTROL MEASURE 'J' ROUTING RESULTS**

| Return Period | Inflow [cfs] | Outflow [cfs] | Max. WSE [ft] |
|---|---|---|---|
| 1-Year | 37.4 | 1.2 | 313.11 |
| 10-Year | 73.4 | 23.0 | 314.35 |
| 25-Year | 85.9 | 48.2 | 314.72 |
| 100-Year | 104.1 | 74.0 | 315.10 |

| Freeboard |
| --- |
| [ft] |
| 2.89 |
| 1.65 |
| 1.28 |
| 0.90 |

THE POINT
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**POST-DEVELOPMENT
NITROGEN EXPORT CALCULATIONS**

T. DABOLT
11/25/2020

*TN-Loading Input Data*

| Sub-basin ID | Nitrogen Analysis Area [acres] | | | | |
|---|---|---|---|---|---|
| | Open | Wooded | Impervious | Pond | Total |
| To SWMF | 73.94 | 0.04 | 27.46 | 1.87 | 103.31 |
| Bypass Area | 147.76 | 42.42 | 2.61 | 6.96 | 199.74 |
| *Totals =* | 221.70 | 42.45 | 30.07 | 8.83 | 303.05 |

*TN-Loading Output Data*

| Sub-basin ID | Nitrogen Analysis Area [acres] | TN-Load Before Treatment [lbs/yr] | % Removal | TN-Load After Treatment [lbs/yr] | BMP Type |
|---|---|---|---|---|---|
| To SWMF | 103.31 | 673.23 | 30% | 471.26 | Wet Pond |
| Bypass Area | 199.74 | 283.45 | 0% | 283.45 | - |
| *Totals =* | 303.05 | 956.68 | | 754.71 | |

| | | |
|---|---|---|
| *Total TN-Load After Treatment =* | 754.71 | lbs/yr |
| = | 2.49 | lbs/ac/yr |

*Compute Estimated Offset Payment*

| | | |
|---|---|---|
| Total Nitrogen Analysis Area = | 303.05 | acres |
| Max. TN-Export w/o Offset Payment = | 1090.99 | lbs/yr |
| | 3.60 | lbs/ac/yr |
| Computed TN-Export Before Treatment = | 956.68 | lbs/yr |
| | 3.16 | lbs/ac/yr |
| Computed TN-Export After Treatment = | 754.71 | lbs/yr |
| | 2.49 | lbs/ac/yr |

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POST-DEVELOPMENT
NITROGEN EXPORT CALCULATIONS

T. DABOLT
11/25/2020

*To  SWMF*

METHOD 2:
*Quantifying TN Export from Residentail / Industrial / Commercial Developments when Footprints of all Impervious Surfaces are shown.*

STEP 1:    *Determine the area for each type of land use and enter in Column (2).*
STEP 2:    *Total the areas for each type of land use and enter at the bottom of Column (2).*
STEP 3:    *Multiply the areas in Column (2) by the TN export coefficients in Column (3) and enter in Column (4).*
STEP 4:    *Total the TN exports for each type of land use and enter at the bottom of Column (4).*
STEP 5:    *Determine the export coefficient for the site by dividing the total TN export from uses at the bottom of Column (4) by the total area at the bottom of Column (2).*

| (1) Type of Land Cover | (2) Area [acres] | (3) TN export coeff. (lbs/ac/yr) | (4) TN export from use (lbs/yr) | |
|---|---|---|---|---|
| *Permanently protected undisturbed open space*  (forest, unmown meadow) | 0.00 | 0.6 | 0.00 | |
| *Permanently protected managed open space*  (grass, landscaping, etc.) | 75.85 | 1.2 | 91.02 | *<== Includes BMP Area* |
| *Impervious surfaces*  (roads, parking lots, driveways, roofs, paved storage areas, etc.) | 27.46 | 21.2 | 582.21 | |
| TOTAL | 103.31 | --- | 673.23 | |

Total TN Export =    6.5    lbs/ac/yr
% impervious =    26.6%

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AWH20000

**POST-DEVELOPMENT**
**NITROGEN EXPORT CALCULATIONS**
*Bypass Area*

T. DABOLT
11/25/2020

METHOD 2:
*Quantifying TN Export from Residentail / Industrial / Commercial Developments when Footprints of all Impervious Surfaces are shown.*

STEP 1: *Determine the area for each type of land use and enter in Column (2).*
STEP 2: *Total the areas for each type of land use and enter at the bottom of Column (2).*
STEP 3: *Multiply the areas in Column (2) by the TN export coefficients in Column (3) and enter in Column (4).*
STEP 4: *Total the TN exports for each type of land use and enter at the bottom of Column (4).*
STEP 5: *Determine the export coefficient for the site by dividing the total TN export from uses at the bottom of Column (4) by the total area at the bottom of Column (2).*

| (1) Type of Land Cover | (2) Area [acres] | (3) TN export coeff. (lbs/ac/yr) | (4) TN export from use (lbs/yr) |
|---|---|---|---|
| *Permanently protected undisturbed open space* (forest, unmown meadow) | 0.00 | 0.6 | 0.00 |
| *Permanently protected managed open space* (grass, landscaping, etc.) | 190.17 | 1.2 | 228.21 |
| *Impervious surfaces* (roads, parking lots, driveways, roofs, paved storage areas, etc.) | 2.61 | 21.2 | 55.24 |
| TOTAL | 192.78 | --- | 283.45 |

Total TN Export = 1.5 lbs/ac/yr
% impervious = 1.4%

# MISCELLANEOUS SITE INFORMATION
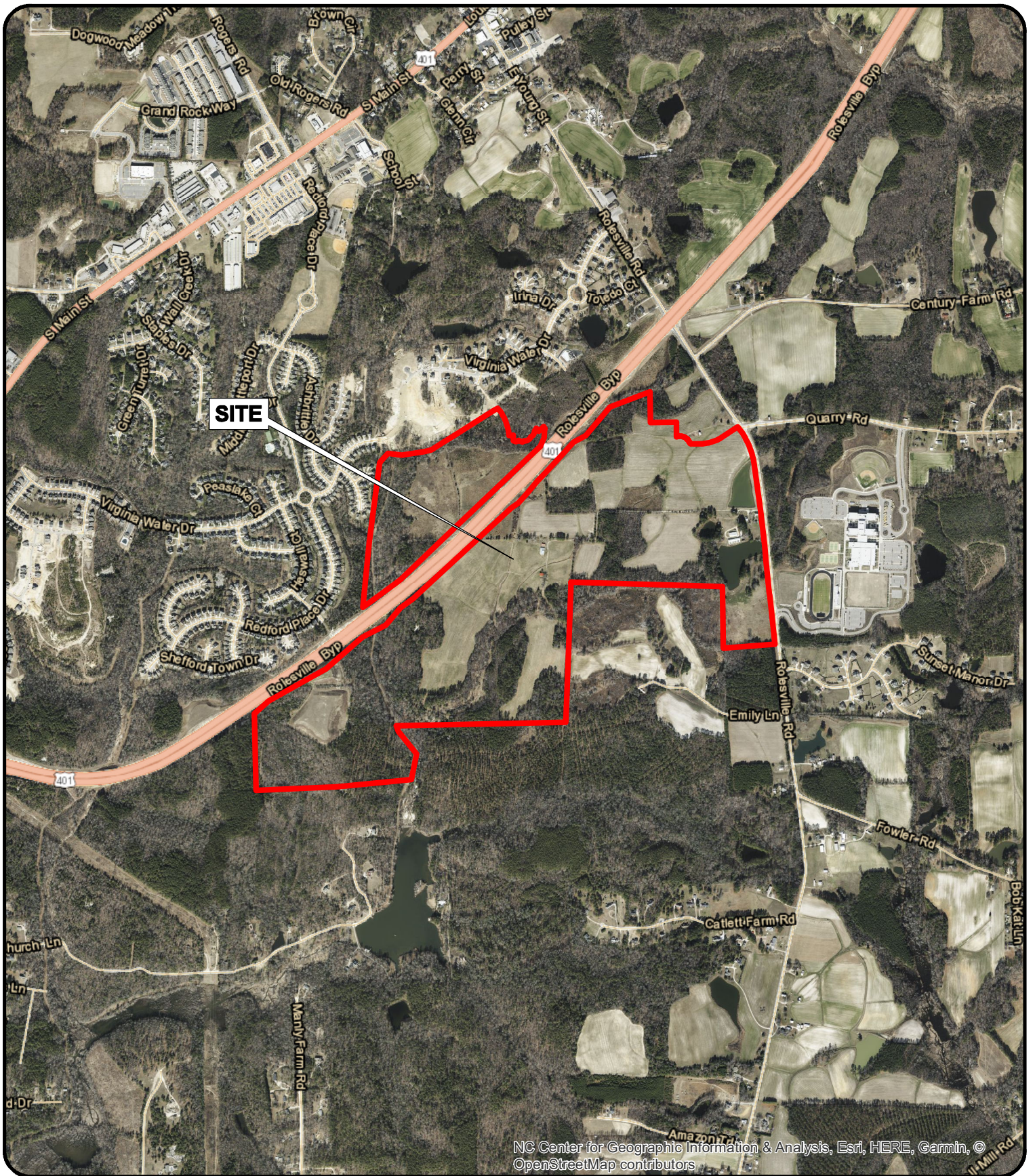
SITE

N

0    750    1,500    3,000
Feet
1 inch = 1,500 feet

**THE POINT**

**SITE AERIAL MAP**
**PROJECT #: AWH-20000**
ROLESVILLE, NORTH CAROLINA

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SITE

N

**THE POINT**

**USGS TOPO MAP**
**PROJECT #: AWH-20000**

ROLESVILLE, NORTH CAROLINA
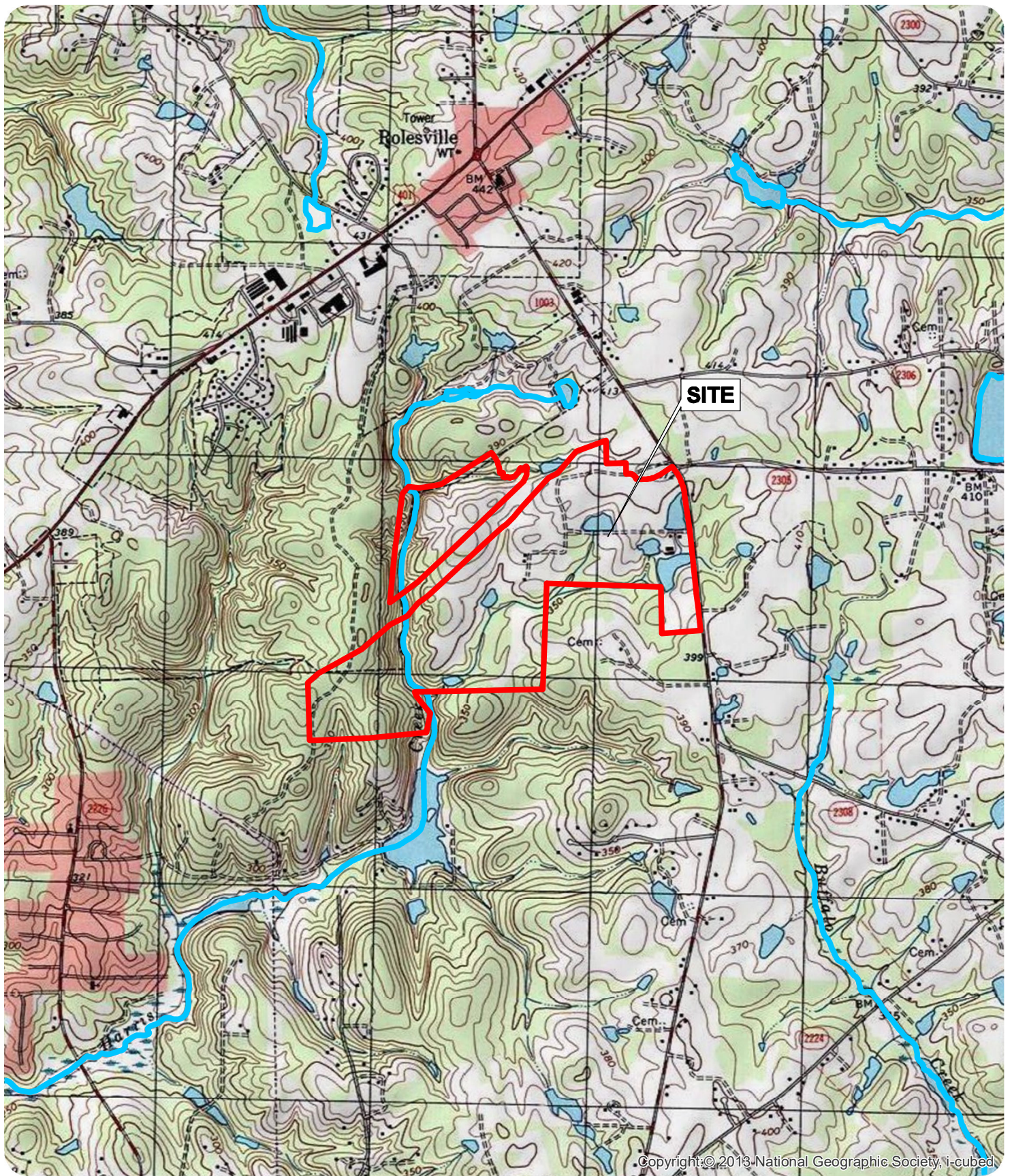
0    1,000    2,000         4,000
Feet
1 inch = 2,000 feet

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| Name of Stream | Description | Class | Class Date | Index No. |
|---|---|---|---|---|
| NEUSE RIVER | From a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake to Town of Wake Forest proposed water supply intake | WS-IV;NSW,CA | 07/01/04 | 27-(22) |
| NEUSE RIVER | From Town of Wake Forest proposed water supply intake to mouth of Beddingfield Creek | C;NSW | 08/03/92 | 27-(22.5) |
| Smith Creek | From source to a point 0.3 mile downstream of Franklin-Wake County Line | WS-II;HQW,NSW | 08/03/92 | 27-23-(1) |
| Smith Creek (Wake Forest Reservoir) | From a point 0.3 mile downstream of Franklin-Wake County Line to dam at Wake Reservoir | WS-II;HQW,NSW, CA | 08/03/92 | 27-23-(1.5) |
| Smith Creek | From dam at Wake Forest Reservoir to Neuse River | C;NSW | 05/01/88 | 27-23-(2) |
| Austin Creek (Mitchell Pond) | From source to Smith Creek | C;NSW | 07/01/96 | 27-23-3 |
| Hatters Branch | From source to Smith Creek | C;NSW | 05/01/88 | 27-23-4 |
| Spring Branch | From source to Hatters Branch | C;NSW | 05/01/88 | 27-23-4-1 |
| Sanford Creek | From source to Smith Creek | C;NSW | 05/01/88 | 27-23-5 |
| Toms Creek (Mill Creek) | From source to Neuse River | C;NSW | 05/01/88 | 27-24 |
| Perry Creek (Greshams Lake) | From source to dam at Greshams Lake | B;NSW | 05/01/88 | 27-25-(1) |
| Perry Creek | From dam at Greshams Lake to Neuse River | C;NSW | 05/01/88 | 27-25-(2) |
| Unnamed Tributary near Neuse | From source to dam at Camp Durant | B;NSW | 05/01/88 | 27-25-3-(1) |
| Unnamed Tributary near Neuse | From dam at Camp Durant to Perry Creek | C;NSW | 05/01/88 | 27-25-3-(2) |
| Harris Creek (Peeples Creek) (Wake Crossroads Lake) | From source to Neuse River | C;NSW | 05/01/88 | 27-26 |
| Hodges Mill Creek (Lake Mirl) | From source to water intake at Lake Mirl | B;NSW | 05/01/88 | 27-26-1-(1) |
| Hodges Mill Creek | From water intake at Lake Mirl to Harris Creek | C;NSW | 05/01/88 | 27-26-1-(2) |
| Beaverdam Creek (west side of Neuse River) | From source to Neuse River | C;NSW | 05/01/88 | 27-27 |
| Rocky Creek | From source to Neuse River | C;NSW | 05/01/88 | 27-28 |
| Beaverdam Creek (east side of Neuse River) (Neuseco Lake, Beaverdam Lake) | From soruce to Neuse River | C;NSW | 05/01/88 | 27-29 |
| Bridges Creek (Bridges Lake) | From source to Neuse River | C;NSW | 05/01/88 | 27-30 |
| Milburnie Creek (Milburnie Lake) | From source to Neuse River | C;NSW | 05/01/88 | 27-31 |
| Mango Creek | From source to Neuse River | C;NSW | 05/01/88 | 27-32 |
| Crabtree Creek | From source to backwaters of Crabtree Lake | C;NSW | 05/01/88 | 27-33-(1) |
| Turkey Creek | From source to Crabtree Creek | C;NSW | 05/01/88 | 27-33-2 |
| Coles Branch | From source to Crabtree Creek | C;NSW | 05/01/88 | 27-33-3 |
| South Fork Coles Branch | From source to Coles Branch | C;NSW | 05/01/88 | 27-33-3-1 |
| Crabtree Creek (Crabtree Lake) | From backwaters of Crabtree Lake to mouth of Richlands Creek | B;NSW | 04/01/94 | 27-33-(3.5) |

Map labels (aerial photo):
TOWN OF ROLESVILLE 370468
TOWN OF ROLESVILLE ETJ 370468
ZONE AE
ZONE A
SITE
TOWN OF ROLESVILLE ETJ 370468
TOWN OF ROLESVILLE 370468
WAKE COUNTY UNINCORPORATED AREAS 370368
Buffalo Creek (formerly Stream 1)
Buffalo Creek Basin 9 Stream H
ZONE AE
Quarry Rd
Century Farm Rd
Rogers Rd

Coordinate labels:
790000 FEET, 2160000 FEET, 78°27'30"W, 78°27'0"W, 78°26'30"W, 78°26'0"W, 2170000 FEET
35°55'0"N, 35°54'30"N, 35°54'0"N
780000 FEET

NORTH CAROLINA Cooperating Technical State
FEMA'S COOPERATING TECHNICAL PARTNER

This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map flood hazard areas at the local level. As a part of this effort, the State of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

## FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT HTTP://FRIS.NC.GOV/FRIS

**SPECIAL FLOOD HAZARD AREAS**
Without Base Flood Elevation (BFE) Zone A, V, A99
With BFE or Depth Zone AE, AO, AH, VE, AR
Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**
0.2% Annual Chance Flood Hazard, Areas of 1% Annual Chance Flood with Average Depth Less Than One Foot or With Drainage Areas of Less Than One Square Mile Zone X
Future Conditions 1% Annual Chance Flood Hazard Zone X
Area with Reduced Flood Risk due to Levee See Notes Zone X

**OTHER AREAS**
Areas Determined to be Outside the 0.2% Annual Chance Floodplain Zone X

**GENERAL STRUCTURES**
Channel, Culvert, or Storm Sewer
Accredited or Provisionally Accredited Levee, Dike, or Floodwall
Non-accredited Levee, Dike, or Floodwall
BM5510 North Carolina Geodetic Survey bench mark
BM5510 National Geodetic Survey bench mark
BM5510 Contractor Est. NCFMP Survey bench mark
012 18.2 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
8 Coastal Transect
Coastal Transect Baseline
Profile Baseline
Hydrographic Feature

**OTHER FEATURES**
Limit of Study
Jurisdiction Boundary

## NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products of the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be available. Visit the North Carolina Floodplain Mapping Program website at http://www.ncfloodmaps.com, or contact the FEMA Map Service Center.

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LIMIT OF MODERATE WAVE ACTION NOTES TO USERS: For some coastal flooding zones the AE Zone category has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

Limit of Moderate Wave Action (LiMWA)

COASTAL BARRIER RESOURCES SYSTEM (CBRS) NOTE

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CBRS Area
Otherwise Protected Area

## SCALE

Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 500 feet    1:6,000

0  250  500  1,000 Feet
0  75  150  300 Meters

## PANEL LOCATOR

GRANVILLE COUNTY
DURHAM COUNTY
FRANKLIN COUNTY
1804
1768
0704
WAKE COUNTY
JOHNSTON COUNTY
HARNETT COUNTY

NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM
NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

## NORTH CAROLINA

PANEL 1768

FEMA
National Flood Insurance Program

Panel Contains:

| COMMUNITY | CID | PANEL | SUFFIX |
|---|---|---|---|
| ROLESVILLE, TOWN OF | 370468 | 1768 | J |
| WAKE COUNTY | 370368 | 1768 | J |

MAP NUMBER
3720176800J

MAP REVISED
05/02/06

Map margin coordinates and labels:

790000 FEET · 2150000 FEET · 78°29'30"W · 78°29'0"W · 78°28'30"W · 78°28'0"W · 2160000 FEET · 790000 FEET

35°55'0"N · 35°55'0"N
35°54'30"N · 35°54'30"N
35°54'0"N · 35°54'0"N

780000 FEET · 2150000 FEET · 78°29'30"W · 78°29'0"W · 78°28'30"W · 78°28'0"W · 2160000 FEET · 780000 FEET

SITE

Map labels: TOWN OF ROLESVILLE 370468 · TOWN OF ROLESVILLE ETJ 370468 · WAKE COUNTY UNINCORPORATED AREAS 370368 · ZONE AE · ZONE A · EZ2419 · EZ2420 · EZ2421

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NORTH CAROLINA
Cooperating Technical State
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Without Base Flood Elevation (BFE) *Zone A,V, A99*
With BFE or Depth *Zone AE, AO, AH, VE, AR*

**OTHER AREAS OF FLOOD HAZARD**

0.2% Annual Chance Flood Hazard, Areas of 1% Annual Chance Flood with Average Depth Less Than One Foot or With Drainage Areas of Less Than One Square Mile *Zone X*

Future Conditions 1% Annual Chance Flood Hazard *Zone X*

Area with Reduced Flood Risk due to Levee See Notes *Zone X*

**OTHER AREAS**

Areas Determined to be Outside the 0.2% Annual Chance Floodplain *Zone X*

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Channel, Culvert, or Storm Sewer
Accredited or Provisionally Accredited Levee, Dike, or Floodwall
Non-accredited Levee, Dike, or Floodwall

BM5510 ✕  North Carolina Geodetic Survey bench mark
BM5510 ⊗  National Geodetic Survey bench mark
BM5510 ⊙  Contractor Est. NCFMP Survey bench mark
⟨012⟩—18.2  Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
⑧ — — —  Coastal Transect
— — — —  Coastal Transect Baseline
———  Profile Baseline
———  Hydrographic Feature
———  Limit of Study
———  Jurisdiction Boundary

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▨ CBRS Area        ▨ Otherwise Protected Area

## SCALE

Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 500 feet          1:6,000

0  250  500  1,000  Feet
0  75  150  300  Meters

## PANEL LOCATOR



GRANVILLE COUNTY · FRANKLIN COUNTY · DURHAM COUNTY · JOHNSTON COUNTY · HARNETT COUNTY

PROJECT BOUNDARY

N

0   750   1,500          3,000
                              Feet

1 inch = 1,500 feet

**THE POINT**
SOIL MAP
**PROJECT #: AWH-20000**
ROLESVILLE, NORTH CAROLINA

McADAMS

Map Scale: 1:11,800 if printed on A landscape (11" x 8.5") sheet.

N

| | | | Meters |
|---|---|---|---|
| 0 | 150 | 300 | 600 | 900 |

| | | | Feet |
|---|---|---|---|
| 0 | 500 | 1000 | 2000 | 3000 |

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 17N WGS84

USDA   **Natural Resources**
**Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

6/3/2020
Page 1 of 4

## MAP LEGEND

### Area of Interest (AOI)
☐ Area of Interest (AOI)

### Soils

#### Soil Rating Polygons
▨ A

▨ A/D

▨ B

▨ B/D

▨ C

▨ C/D

▨ D

☐ Not rated or not available

#### Soil Rating Lines
〜 A

〜 A/D

〜 B

〜 B/D

〜 C

〜 C/D

〜 D

〜 Not rated or not available

#### Soil Rating Points
■ A

■ A/D

■ B

■ B/D

■ C

■ C/D

■ D

☐ Not rated or not available

### Water Features
〜 Streams and Canals

### Transportation
+++ Rails

〜 Interstate Highways

〜 US Routes

〜 Major Roads

〜 Local Roads

### Background
▨ Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map:    Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System:    Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area:    Wake County, North Carolina
Survey Area Data:    Version 18, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed:    Oct 11, 2019—Oct 19, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

USDA  **Natural Resources**
**Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

6/3/2020
Page 2 of 4

# Hydrologic Soil Group

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| AaA | Altavista fine sandy loam, 0 to 4 percent slopes, rarely flooded | C | 4.1 | 1.4% |
| AuA | Augusta fine sandy loam, 0 to 2 percent slopes, rarely flooded | C/D | 10.1 | 3.3% |
| ChA | Chewacla and Wehadkee soils, 0 to 2 percent slopes, frequently flooded | B/D | 27.0 | 8.9% |
| HeB | Helena sandy loam, 2 to 6 percent slopes | D | 7.1 | 2.4% |
| RgB | Rawlings-Rion complex, 2 to 6 percent slopes | C | 43.5 | 14.4% |
| RgC | Rawlings-Rion complex, 6 to 10 percent slopes | C | 45.6 | 15.1% |
| RgD | Rawlings-Rion complex, 10 to 15 percent slopes | C | 15.0 | 5.0% |
| W | Water | | 9.7 | 3.2% |
| WaB | Wake-Rolesville complex, 2 to 6 percent slopes, very rocky | D | 7.4 | 2.4% |
| WaC | Wake-Rolesville complex, 6 to 10 percent slopes, very rocky | D | 29.0 | 9.6% |
| WaD | Wake-Rolesville complex, 10 to 15 percent slopes, very rocky | D | 51.1 | 16.9% |
| WaE | Wake-Rolesville complex, 15 to 25 percent slopes, very rocky | D | 28.9 | 9.6% |
| WeB | Wedowee sandy loam, 2 to 6 percent slopes | D | 0.2 | 0.1% |
| WfB | Wedowee-Saw complex, 2 to 6 percent slopes | D | 22.9 | 7.6% |
| WgC | Wedowee-Urban land complex, 6 to 15 percent slopes | D | 0.1 | 0.0% |
| **Totals for Area of Interest** | | | **301.6** | **100.0%** |

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Higher

**NOAA Atlas 14, Volume 2, Version 3**
**Location name: Wake Forest, North Carolina, USA***
**Latitude: 35.9053°, Longitude: -78.452°**
**Elevation: 354.67 ft****
* source: ESRI Maps
** source: USGS

## POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

## PF tabular

| Duration | PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Average recurrence interval (years) | | | | | | | | | |
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | 0.403 (0.369-0.442) | 0.468 (0.429-0.512) | 0.534 (0.489-0.582) | 0.600 (0.548-0.654) | 0.666 (0.606-0.726) | 0.718 (0.651-0.783) | 0.765 (0.690-0.834) | 0.807 (0.723-0.881) | 0.853 (0.758-0.932) | 0.895 (0.789-0.979) |
| 10-min | 0.644 (0.590-0.705) | 0.749 (0.687-0.818) | 0.855 (0.783-0.933) | 0.959 (0.877-1.05) | 1.06 (0.966-1.16) | 1.14 (1.04-1.25) | 1.22 (1.10-1.33) | 1.28 (1.15-1.40) | 1.35 (1.20-1.47) | 1.41 (1.24-1.54) |
| 15-min | 0.806 (0.738-0.882) | 0.942 (0.863-1.03) | 1.08 (0.991-1.18) | 1.21 (1.11-1.32) | 1.35 (1.22-1.47) | 1.45 (1.31-1.58) | 1.54 (1.39-1.68) | 1.61 (1.45-1.76) | 1.70 (1.51-1.86) | 1.77 (1.56-1.94) |
| 30-min | 1.10 (1.01-1.21) | 1.30 (1.19-1.42) | 1.54 (1.41-1.68) | 1.76 (1.61-1.92) | 1.99 (1.81-2.17) | 2.18 (1.98-2.38) | 2.35 (2.12-2.57) | 2.51 (2.25-2.74) | 2.70 (2.40-2.95) | 2.87 (2.52-3.14) |
| 60-min | 1.38 (1.26-1.51) | 1.63 (1.50-1.78) | 1.97 (1.81-2.15) | 2.29 (2.09-2.50) | 2.65 (2.42-2.89) | 2.96 (2.68-3.22) | 3.24 (2.92-3.53) | 3.52 (3.16-3.85) | 3.88 (3.45-4.24) | 4.18 (3.69-4.58) |
| 2-hr | 1.61 (1.46-1.78) | 1.92 (1.75-2.10) | 2.34 (2.13-2.56) | 2.75 (2.49-3.01) | 3.23 (2.91-3.54) | 3.66 (3.28-4.00) | 4.07 (3.63-4.45) | 4.49 (3.98-4.91) | 5.04 (4.42-5.51) | 5.52 (4.80-6.05) |
| 3-hr | 1.71 (1.55-1.89) | 2.03 (1.85-2.24) | 2.49 (2.26-2.74) | 2.94 (2.67-3.24) | 3.50 (3.15-3.84) | 3.99 (3.58-4.39) | 4.49 (3.98-4.92) | 5.00 (4.41-5.48) | 5.69 (4.96-6.24) | 6.32 (5.45-6.95) |
| 6-hr | 2.05 (1.87-2.26) | 2.44 (2.23-2.68) | 2.99 (2.72-3.28) | 3.54 (3.22-3.88) | 4.22 (3.82-4.62) | 4.84 (4.35-5.29) | 5.46 (4.86-5.96) | 6.12 (5.39-6.67) | 7.00 (6.10-7.64) | 7.82 (6.72-8.55) |
| 12-hr | 2.41 (2.21-2.66) | 2.87 (2.64-3.15) | 3.54 (3.24-3.88) | 4.21 (3.84-4.62) | 5.07 (4.59-5.53) | 5.85 (5.26-6.36) | 6.64 (5.91-7.22) | 7.49 (6.59-8.14) | 8.66 (7.50-9.41) | 9.76 (8.32-10.6) |
| 24-hr | 2.86 (2.66-3.08) | 3.46 (3.22-3.73) | 4.35 (4.04-4.69) | 5.06 (4.69-5.44) | 6.02 (5.57-6.49) | 6.80 (6.27-7.32) | 7.60 (6.98-8.19) | 8.43 (7.71-9.09) | 9.58 (8.71-10.3) | 10.5 (9.50-11.3) |
| 2-day | 3.32 (3.09-3.57) | 3.99 (3.72-4.30) | 4.98 (4.64-5.37) | 5.77 (5.35-6.21) | 6.83 (6.32-7.36) | 7.68 (7.09-8.27) | 8.56 (7.87-9.22) | 9.46 (8.66-10.2) | 10.7 (9.74-11.6) | 11.7 (10.6-12.7) |
| 3-day | 3.52 (3.28-3.77) | 4.23 (3.94-4.54) | 5.25 (4.89-5.63) | 6.06 (5.64-6.50) | 7.17 (6.64-7.69) | 8.05 (7.44-8.64) | 8.96 (8.25-9.62) | 9.89 (9.07-10.6) | 11.2 (10.2-12.1) | 12.2 (11.1-13.2) |
| 4-day | 3.72 (3.47-3.98) | 4.46 (4.17-4.77) | 5.52 (5.15-5.90) | 6.35 (5.92-6.79) | 7.50 (6.96-8.01) | 8.42 (7.79-9.00) | 9.36 (8.63-10.0) | 10.3 (9.49-11.1) | 11.7 (10.7-12.5) | 12.7 (11.6-13.7) |
| 7-day | 4.31 (4.04-4.61) | 5.15 (4.82-5.50) | 6.29 (5.88-6.71) | 7.19 (6.72-7.68) | 8.43 (7.85-9.00) | 9.42 (8.75-10.1) | 10.4 (9.66-11.2) | 11.5 (10.6-12.3) | 12.9 (11.8-13.9) | 14.1 (12.8-15.1) |
| 10-day | 4.91 (4.61-5.24) | 5.85 (5.48-6.23) | 7.04 (6.60-7.50) | 7.99 (7.47-8.50) | 9.26 (8.64-9.86) | 10.3 (9.55-10.9) | 11.3 (10.5-12.0) | 12.3 (11.4-13.2) | 13.7 (12.6-14.7) | 14.8 (13.6-15.9) |
| 20-day | 6.59 (6.20-7.02) | 7.79 (7.32-8.29) | 9.23 (8.67-9.81) | 10.4 (9.72-11.0) | 11.9 (11.1-12.7) | 13.1 (12.2-14.0) | 14.3 (13.3-15.3) | 15.6 (14.5-16.6) | 17.3 (16.0-18.5) | 18.6 (17.1-19.9) |
| 30-day | 8.18 (7.72-8.69) | 9.63 (9.08-10.2) | 11.2 (10.6-11.9) | 12.5 (11.7-13.2) | 14.1 (13.2-15.0) | 15.4 (14.4-16.3) | 16.6 (15.5-17.7) | 17.9 (16.7-19.0) | 19.5 (18.1-20.9) | 20.8 (19.3-22.3) |
| 45-day | 10.4 (9.89-11.0) | 12.2 (11.6-12.9) | 14.0 (13.3-14.8) | 15.4 (14.6-16.2) | 17.2 (16.3-18.1) | 18.6 (17.5-19.6) | 19.9 (18.7-21.0) | 21.2 (19.9-22.5) | 23.0 (21.5-24.4) | 24.3 (22.7-25.8) |
| 60-day | 12.5 (11.9-13.1) | 14.6 (13.9-15.4) | 16.6 (15.7-17.4) | 18.1 (17.1-19.0) | 20.0 (19.0-21.1) | 21.5 (20.3-22.6) | 22.9 (21.6-24.1) | 24.2 (22.9-25.6) | 26.0 (24.5-27.5) | 27.4 (25.7-29.0) |

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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## PF graphical

## PDS-based depth-duration-frequency (DDF) curves
### Latitude: 35.9053°, Longitude: -78.4520°



Average recurrence interval (years)

- 1
- 2
- 5
- 10
- 25
- 50
- 100
- 200
- 500
- 1000



| Duration | |
|---|---|
| 5-min | 2-day |
| 10-min | 3-day |
| 15-min | 4-day |
| 30-min | 7-day |
| 60-min | 10-day |
| 2-hr | 20-day |
| 3-hr | 30-day |
| 6-hr | 45-day |
| 12-hr | 60-day |
| 24-hr | |
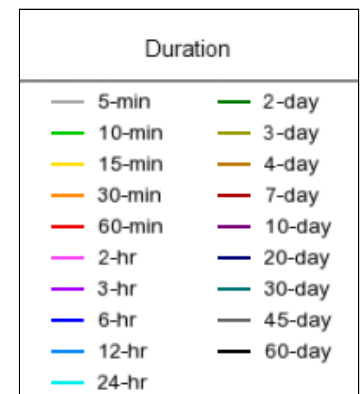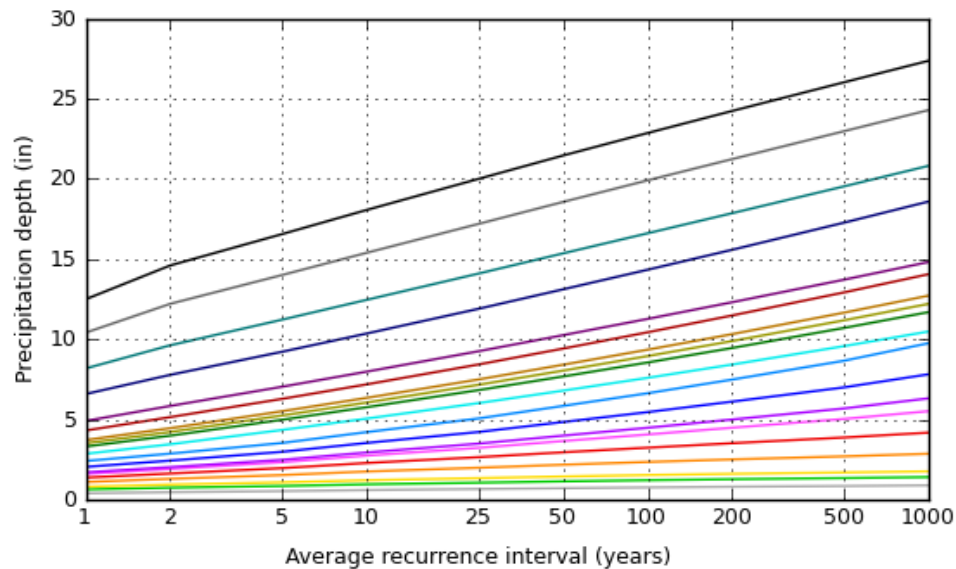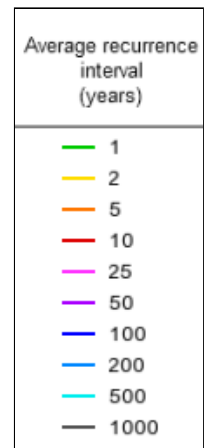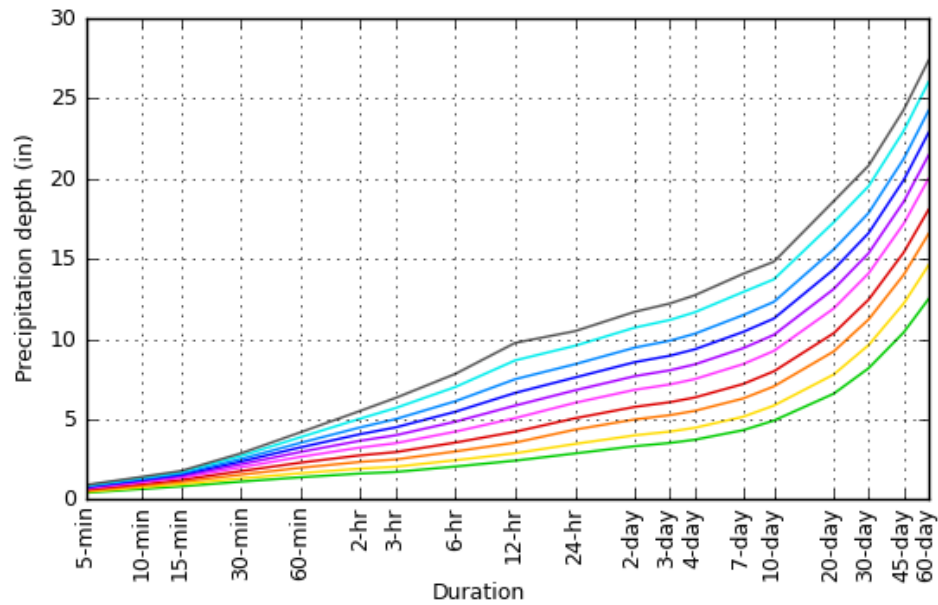
NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Wed Jun  3 19:09:38 2020

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## Maps & aerials

**Small scale terrain**
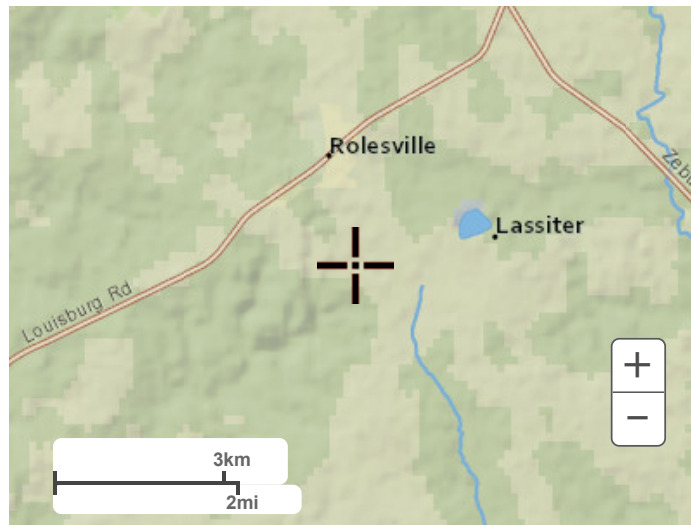
**Large scale terrain**

**Large scale map**
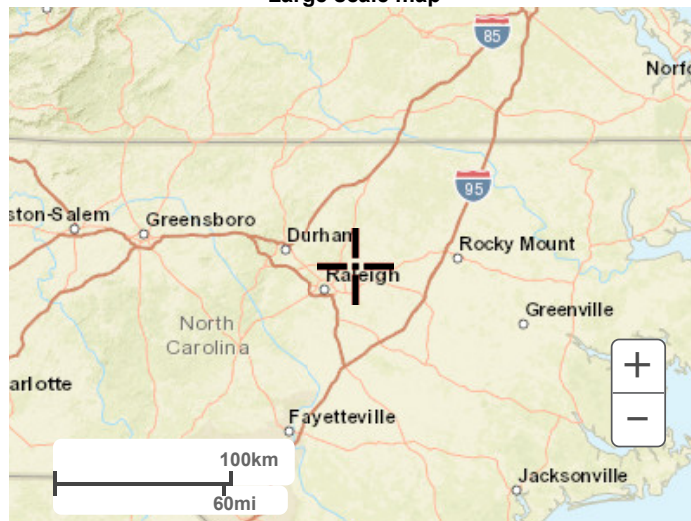
**Large scale aerial**
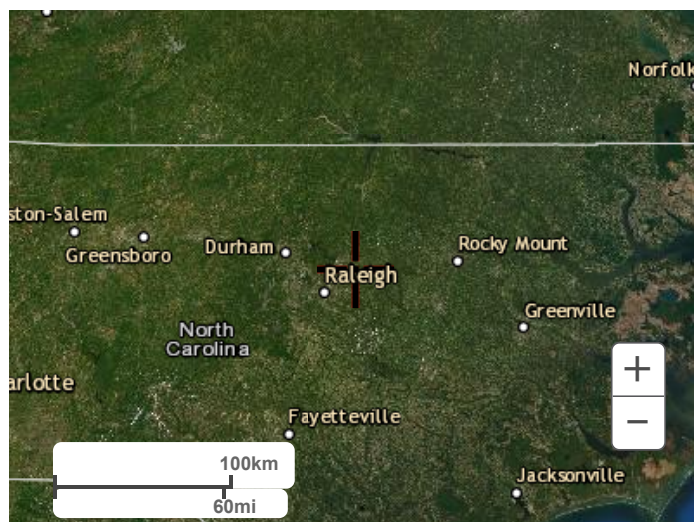
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*PRE-DEVELOPMENT*
*HYDROLOGIC CALCULATIONS*

**The Point**
AWH-20000

THE POINT
AWH-20000

**PRE-DEVELOPMENT HYDROLOGY**
*Subbasin 1*

L. KABRICH, EI
6/18/2020

| Land Use | HSG | CN | Onsite | Percent Impervious (%) | Impervious Area (ac) | Total Area (ac) |
|---|---|---|---|---|---|---|
| Crops | B | 78 | Yes | 0 | 0.00 | 23.79 |
| Crops | B/D | 89 | Yes | 0 | 0.00 | 0.13 |
| Crops | D | 89 | Yes | 0 | 0.00 | 6.70 |
| Low Density Residential | B | 68 | | 20 | 0.06 | 0.29 |
| Low Density Residential | D | 84 | | 20 | 4.53 | 22.63 |
| Medium Density Residential | B | 70 | | 25 | 0.29 | 1.14 |
| Medium Density Residential | D | 85 | | 25 | 0.02 | 0.08 |
| Mixed Use Neighborhood | B | 85 | | 65 | 9.26 | 14.25 |
| Mixed Use Neighborhood | B/D | 92 | | 65 | 2.68 | 4.12 |
| Mixed Use Neighborhood | C | 90 | | 65 | 1.16 | 1.79 |
| Mixed Use Neighborhood | D | 92 | | 65 | 10.60 | 16.30 |
| Open | B | 61 | Yes | 0 | 0.00 | 16.63 |
| Open | B/D | 80 | Yes | 0 | 0.00 | 0.38 |
| Open | D | 80 | Yes | 0 | 0.00 | 8.88 |
| Pond | B | 100 | Yes | 0 | 0.00 | 0.13 |
| Pond | B/D | 100 | Yes | 0 | 0.00 | 0.02 |
| Pond | D | 100 | Yes | 0 | 0.00 | 6.78 |
| Roadway | | 98 | | 100 | 7.98 | 7.98 |
| Roof | B | 98 | Yes | 100 | 0.35 | 0.35 |
| Roof | D | 98 | Yes | 100 | 0.00 | 0.00 |
| School | B | 88 | | 72 | 12.90 | 17.91 |
| School | B/D | 93 | | 72 | 6.11 | 8.49 |
| School | D | 93 | | 72 | 43.84 | 60.89 |
| Trail | B | 82 | Yes | 100 | 0.52 | 0.52 |
| Trail | B/D | 89 | Yes | 100 | 0.01 | 0.01 |
| Trail | D | 89 | Yes | 100 | 0.11 | 0.11 |
| Wooded | B | 55 | Yes | 0 | 0.00 | 8.52 |
| Wooded | B/D | 77 | Yes | 0 | 0.00 | 6.40 |
| Wooded | C | 70 | Yes | 0 | 0.00 | 0.03 |
| Wooded | D | 77 | Yes | 0 | 0.00 | 1.61 |

| | | |
|---|---|---|
| **Total Area** | 236.88 | ac |
| **Total Impervious Area** | 100.42 | ac |
| **Onsite Area** | 81.00 | ac |
| **Onsite Impervious Area** | 0.99 | ac |
| **Percent Impervious** | 42 | % |
| **Composite Curve Number** | 89 | |

THE POINT
AWH-20000

**PRE-DEVELOPMENT HYDROLOGY**
*Subbasin 1*

L. KABRICH, EI
6/18/2020

**Time of Concentration Information**
*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

| *Segment 1: Overland Flow* | | | | *Segment 2: Concentrated Flow* | | |
|---|---|---|---|---|---|---|
| Length = | 100 | ft | | Length = | 2645 | ft |
| Top Elev = | 426.00 | ft | | Top Elev = | 425.00 | ft |
| Bot Elev = | 425.00 | ft | | Bot Elev = | 374.00 | ft |
| Height = | 1 | ft | | Height = | 51 | ft |
| Slope = | 0.0100 | ft/ft | | Slope = | 0.0193 | ft/ft |
| Manning's n = | 0.17 | cultivated soils, residue cover | | Paved ? = | No | |
| P (2-year/24-hour) = | 3.46 | inches (Rolesville, NC) | | Velocity = | 2.24 | ft/sec |
| *Segment Time =* | *13.74* | *minutes* | | *Segment Time =* | *19.68* | *minutes* |

| *Segment 3: Open Water Flow* | | | | *Segment 4: Channel Flow* | | |
|---|---|---|---|---|---|---|
| Length = | 580 | ft | | Length = | 2088 | ft |
| Top Elev = | 374.00 | ft | | Top Elev = | 372.00 | ft |
| Bot Elev = | 372.00 | ft | | Bot Elev = | 344.00 | ft |
| *Segment Time =* | *0.00* | *minutes* | | Height = | 28 | ft |
| | | | | Slope = | 0.0134 | ft/ft |
| | | | | Manning's n = | 0.045 | natural channel |
| | | | | Flow Area = | 15.00 | sf (assume 5'w x 3'h channel) |
| | | | | Wetted Perimeter = | 11.00 | lf (assume 5'w x 3'h channel) |
| | | | | Channel Velocity = | 4.72 | ft/sec |
| | | | | *Segment Time =* | *7.38* | *minutes* |

| | | |
|---|---|---|
| **Time of Concentration =** | 40.80 | minutes |
| **SCS Lag Time =** | 24.48 | minutes (SCS Lag = 0.6* Tc) |
| **Time Increment =** | 7.10 | minutes (= 0.29*SCS Lag) |

THE POINT
AWH-20000

**PRE-DEVELOPMENT HYDROLOGY**
*Subbasin 2*

L. KABRICH, EI
6/18/2020

| Land Use | HSG | CN | Onsite | Percent Impervious (%) | Impervious Area (ac) | Area (ac) |
|---|---|---|---|---|---|---|
| Crops | B | 78 | Yes | 0 | 0.00 | 1.34 |
| Crops | D | 89 | Yes | 0 | 0.00 | 0.55 |
| Low Density Residential | D | 84 | | 20 | 3.59 | 17.96 |
| Mixed Use Neighborhood | B | 85 | | 65 | 3.44 | 5.30 |
| Mixed Use Neighborhood | B/D | 92 | | 65 | 0.58 | 0.89 |
| Mixed Use Neighborhood | D | 92 | | 65 | 8.11 | 12.48 |
| Open | B | 61 | Yes | 0 | 0.00 | 0.92 |
| Open | D | 80 | Yes | 0 | 0.00 | 0.75 |
| Roadway | | 98 | | 100 | 13.35 | 13.35 |
| Trail | B | 82 | Yes | 100 | 0.07 | 0.07 |
| Trail | D | 89 | Yes | 100 | 0.22 | 0.22 |
| Wooded | B | 55 | Yes | 0 | 0.00 | 2.53 |
| Wooded | B/D | 77 | Yes | 0 | 0.00 | 1.21 |
| Wooded | D | 77 | Yes | 0 | 0.00 | 2.33 |

| | |
|---|---|
| **Total Area** | 59.90 ac |
| **Total Impervious Area** | 29.36 ac |
| **Onsite Area** | 9.92 ac |
| **Onsite Impervious Area** | 0.28 ac |
| **Percent Impervious** | 49 % |
| **Composite Curve Number** | 87 |

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

*Segment 1: Overland Flow*

| | | |
|---|---|---|
| Length = | 100 | ft |
| Top Elev = | 427.00 | ft |
| Bot Elev = | 426.00 | ft |
| Height = | 1 | ft |
| Slope = | 0.0100 | ft/ft |
| Manning's n = | 0.17 | cultivated soils, residue cover |
| P (2-year/24-hour) = | 3.46 | inches (Rolesville, NC) |
| *Segment Time =* | *13.74* | *minutes* |

*Segment 2: Concentrated Flow*

| | | |
|---|---|---|
| Length = | 2541 | ft |
| Top Elev = | 426.00 | ft |
| Bot Elev = | 368.00 | ft |
| Height = | 58 | ft |
| Slope = | 0.0228 | ft/ft |
| Paved ? = | No | |
| Velocity = | 2.44 | ft/sec |
| *Segment Time =* | *17.37* | *minutes* |

| | | |
|---|---|---|
| **Time of Concentration =** | 31.12 | minutes |
| **SCS Lag Time =** | 18.67 | minutes (SCS Lag = 0.6* Tc) |
| **Time Increment =** | 5.41 | minutes (= 0.29*SCS Lag) |

THE POINT
AWH-20000

**PRE-DEVELOPMENT HYDROLOGY**
*Subbasin 3*

L. KABRICH, EI
6/18/2020

| Land Use | HSG | CN | Onsite | Percent Impervious (%) | Impervious Area (ac) | Area (ac) |
|----------|-----|----|--------|------------------------|----------------------|-----------|
| Open | C | 74 | Yes | 0 | 0.00 | 1.23 |
| Open | D | 80 | Yes | 0 | 0.00 | 1.45 |
| Wooded | C | 70 | Yes | 0 | 0.00 | 0.85 |
| Wooded | D | 77 | Yes | 0 | 0.00 | 4.59 |

| | | |
|---|---|---|
| **Total Area** | 8.11 | ac |
| **Total Impervious Area** | 0.00 | ac |
| **Onsite Area** | 8.11 | ac |
| **Onsite Impervious Area** | 0.00 | ac |
| **Percent Impervious** | 0 | % |
| **Composite Curve Number** | 76 | |

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

*Segment 1: Overland Flow*

| | | |
|---|---|---|
| Length = | 100 | ft |
| Top Elev = | 368.00 | ft |
| Bot Elev = | 363.00 | ft |
| Height = | 5 | ft |
| Slope = | 0.0500 | ft/ft |
| Manning's n = | 0.24 | dense grasses |
| P (2-year/24-hour) = | 3.46 | inches (Rolesville, NC) |
| **Segment Time =** | **9.51** | **minutes** |

*Segment 2: Concentrated Flow*

| | | |
|---|---|---|
| Length = | 881 | ft |
| Top Elev = | 363.00 | ft |
| Bot Elev = | 336.00 | ft |
| Height = | 27 | ft |
| Slope = | 0.0306 | ft/ft |
| Paved ? = | No | |
| Velocity = | 2.82 | ft/sec |
| **Segment Time =** | **5.20** | **minutes** |

*Segment 3: Channel Flow*

| | | |
|---|---|---|
| Length = | 249 | ft |
| Top Elev = | 336.00 | ft |
| Bot Elev = | 333.00 | ft |
| Height = | 3 | ft |
| Slope = | 0.0120 | ft/ft |
| Manning's n = | 0.045 | natural channel |
| Flow Area = | 15.00 | sf (assume 5'w x 3'h channel) |
| Wetted Perimeter = | 11.00 | lf (assume 5'w x 3'h channel) |
| Channel Velocity = | 4.47 | ft/sec |
| **Segment Time =** | **0.93** | **minutes** |

| | | |
|---|---|---|
| **Time of Concentration =** | 15.64 | minutes |
| **SCS Lag Time =** | 9.38 | minutes (SCS Lag = 0.6* Tc) |
| **Time Increment =** | 2.72 | minutes (= 0.29*SCS Lag) |

THE POINT
AWH-20000

**PRE-DEVELOPMENT HYDROLOGY**
*Subbasin 4*

L. KABRICH, EI
6/18/2020

| Land Use | HSG | CN | Onsite | Percent Impervious (%) | Impervious Area (ac) | Area (ac) |
|---|---|---|---|---|---|---|
| Crops | B | 78 | Yes | 0 | 0.00 | 6.35 |
| Crops | B/D | 89 | Yes | 0 | 0.00 | 0.16 |
| Crops | D | 89 | Yes | 0 | 0.00 | 3.19 |
| Mixed Use Neighborhood | B | 85 | | 65 | 1.18 | 1.82 |
| Mixed Use Neighborhood | B/D | 92 | | 65 | 0.56 | 0.86 |
| Mixed Use Neighborhood | C | 90 | | 65 | 0.68 | 1.04 |
| Mixed Use Neighborhood | D | 92 | | 65 | 5.08 | 7.81 |
| Open | A | 39 | Yes | 0 | 0.00 | 1.44 |
| Open | B | 61 | Yes | 0 | 0.00 | 10.63 |
| Open | B/D | 80 | Yes | 0 | 0.00 | 8.78 |
| Open | C | 74 | Yes | 0 | 0.00 | 4.91 |
| Open | D | 80 | Yes | 0 | 0.00 | 20.40 |
| Roadway | | 98 | | 100 | 7.47 | 7.47 |
| Roof | B | 98 | Yes | 100 | 0.11 | 0.11 |
| Roof | B/D | 98 | Yes | 100 | 0.00 | 0.00 |
| Roof | D | 98 | Yes | 100 | 0.03 | 0.03 |
| Trail | A | 72 | Yes | 100 | 0.17 | 0.17 |
| Trail | B | 82 | Yes | 100 | 0.39 | 0.39 |
| Trail | B/D | 89 | Yes | 100 | 0.19 | 0.19 |
| Trail | D | 89 | Yes | 100 | 0.69 | 0.69 |
| Wooded | A | 30 | Yes | 0 | 0.00 | 0.00 |
| Wooded | B | 55 | Yes | 0 | 0.00 | 3.07 |
| Wooded | B/D | 77 | Yes | 0 | 0.00 | 9.47 |
| Wooded | C | 70 | Yes | 0 | 0.00 | 7.15 |
| Wooded | D | 77 | Yes | 0 | 0.00 | 12.43 |

| | | |
|---|---|---|
| **Total Area** | 108.57 | ac |
| **Total Impervious Area** | 16.56 | ac |
| **Onsite Area** | 89.56 | ac |
| **Onsite Impervious Area** | 1.59 | ac |
| **Percent Impervious** | 15 | % |
| **Composite Curve Number** | 78 | |

THE POINT
AWH-20000

**PRE-DEVELOPMENT HYDROLOGY**
*Subbasin 4*

L. KABRICH, EI
6/18/2020

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

| *Segment 1: Overland Flow* | | | | *Segment 2: Concentrated Flow* | | |
|---|---|---|---|---|---|---|
| Length = | 100 | ft | | Length = | 1855 | ft |
| Top Elev = | 389.00 | ft | | Top Elev = | 388.00 | ft |
| Bot Elev = | 388.00 | ft | | Bot Elev = | 339.00 | ft |
| Height = | 1 | ft | | Height = | 49 | ft |
| Slope = | 0.0100 | ft/ft | | Slope = | 0.0264 | ft/ft |
| Manning's n = | 0.17 | cultivated soils, residue cover | | Paved ? = | No | |
| P (2-year/24-hour) = | 3.46 | inches (Rolesville, NC) | | Velocity = | 2.62 | ft/sec |
| *Segment Time =* | *13.74* | *minutes* | | *Segment Time =* | *11.79* | *minutes* |

*Segment 3: Channel Flow*

| | | |
|---|---|---|
| Length = | 2366 | ft |
| Top Elev = | 339.00 | ft |
| Bot Elev = | 302.00 | ft |
| Height = | 37 | ft |
| Slope = | 0.0156 | ft/ft |
| Manning's n = | 0.045 | natural channel |
| Flow Area = | 15.00 | sf (assume 5'w x 3'h channel) |
| Wetted Perimeter = | 11.00 | lf (assume 5'w x 3'h channel) |
| Channel Velocity = | 5.09 | ft/sec |
| *Segment Time =* | *7.74* | *minutes* |

| | | | |
|---|---|---|---|
| **Time of Concentration =** | 33.28 | minutes | |
| **SCS Lag Time =** | 19.97 | minutes (SCS Lag = 0.6* Tc) | |
| **Time Increment =** | 5.79 | minutes (= 0.29*SCS Lag) | |

THE POINT
AWH-20000

**PRE-DEVELOPMENT HYDROLOGY**
*Subbasin 5*

L. KABRICH, EI
6/18/2020

| Land Use | HSG | CN | Onsite | Percent Impervious (%) | Impervious Area (ac) | Area (ac) |
|---|---|---|---|---|---|---|
| Business Park | A | 89 | | 85 | 0.01 | 0.01 |
| Business Park | B | 92 | | 85 | 0.02 | 0.02 |
| Business Park | D | 95 | | 85 | 0.03 | 0.03 |
| Commercial | D | 95 | | 85 | 0.86 | 1.01 |
| High Density Residential | B | 85 | | 65 | 46.03 | 70.82 |
| High Density Residential | D | 92 | | 65 | 33.44 | 51.45 |
| Low Density Residential | B | 65 | | 20 | 0.18 | 0.92 |
| Low Density Residential | D | 82 | | 20 | 0.37 | 1.85 |
| Medium Density Residential | A | 54 | | 25 | 0.00 | 0.01 |
| Medium Density Residential | B | 70 | | 25 | 11.98 | 47.92 |
| Medium Density Residential | D | 85 | | 25 | 10.74 | 42.98 |
| Mixed Use Neighborhood | B | 85 | | 65 | 4.36 | 6.71 |
| Mixed Use Neighborhood | B/D | 92 | | 65 | 2.15 | 3.31 |
| Mixed Use Neighborhood | D | 92 | | 65 | 7.50 | 11.55 |
| Open | A | 49 | Yes | 0 | 0.00 | 1.90 |
| Open | B | 69 | Yes | 0 | 0.00 | 10.33 |
| Open | D | 84 | Yes | 0 | 0.00 | 11.86 |
| Preserved Open Space | A | 39 | | 0 | 0.00 | 0.39 |
| Preserved Open Space | B | 61 | | 0 | 0.00 | 4.48 |
| Preserved Open Space | D | 80 | | 0 | 0.00 | 34.05 |
| Roadway | | 98 | | 100 | 49.05 | 49.05 |
| School | B | 88 | | 72 | 0.34 | 0.47 |
| School | D | 93 | | 72 | 5.12 | 7.11 |
| Town Center | B | 92 | | 85 | 5.55 | 6.53 |
| Town Center | D | 95 | | 85 | 1.48 | 1.74 |
| Trail | A | 72 | Yes | 100 | 0.02 | 0.02 |
| Trail | B | 82 | Yes | 100 | 0.43 | 0.43 |
| Trail | D | 89 | Yes | 100 | 1.93 | 1.93 |
| Wooded | A | 30 | Yes | 0 | 0.00 | 0.70 |
| Wooded | B | 55 | Yes | 0 | 0.00 | 4.50 |
| Wooded | B/D | 77 | Yes | 0 | 0.00 | 0.15 |
| Wooded | D | 77 | Yes | 0 | 0.00 | 50.68 |

| | |
|---|---|
| **Total Area** | **424.89 ac** |
| **Total Impervious Area** | **181.60 ac** |
| **Onsite Area** | **82.49 ac** |
| **Onsite Impervious Area** | **2.38 ac** |
| **Percent Impervious** | **43 %** |
| **Composite Curve Number** | **84** |

THE POINT
AWH-20000

**PRE-DEVELOPMENT HYDROLOGY**
*Subbasin 5*

L. KABRICH, EI
6/18/2020

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

| *Segment 1: Overland Flow* | | | | *Segment 2: Concentrated Flow* | | |
|---|---|---|---|---|---|---|
| Length = | 100 | ft | | Length = | 2989 | ft |
| Top Elev = | 440.00 | ft | | Top Elev = | 438.00 | ft |
| Bot Elev = | 438.00 | ft | | Bot Elev = | 372.00 | ft |
| Height = | 2 | ft | | Height = | 66 | ft |
| Slope = | 0.0200 | ft/ft | | Slope = | 0.0221 | ft/ft |
| Manning's n = | 0.24 | dense grasses | | Paved ? = | No | |
| P (2-year/24-hour) = | 3.46 | inches (Rolesville, NC) | | Velocity = | 2.40 | ft/sec |
| *Segment Time =* | *13.72* | *minutes* | | *Segment Time =* | *20.78* | *minutes* |

| *Segment 3: Open Water Flow* | | | | *Segment 4: Concentrated Flow* | | |
|---|---|---|---|---|---|---|
| Length = | 655 | ft | | Length = | 2379 | ft |
| Top Elev = | 372.00 | ft | | Top Elev = | 372.00 | ft |
| Bot Elev = | 372.00 | ft | | Bot Elev = | 320.00 | ft |
| *Segment Time =* | *0.00* | *minutes* | | Height = | 52 | ft |
| | | | | Slope = | 0.0219 | ft/ft |
| | | | | Paved ? = | No | |
| | | | | Velocity = | 2.39 | ft/sec |
| | | | | *Segment Time =* | *16.62* | *minutes* |

| *Segment 5: Channel Flow* | | |
|---|---|---|
| Length = | 3730 | ft |
| Top Elev = | 320.00 | ft |
| Bot Elev = | 292.00 | ft |
| Height = | 28 | ft |
| Slope = | 0.0075 | ft/ft |
| Manning's n = | 0.045 | natural channel |
| Flow Area = | 32.00 | sf (assume 8'w x 4'h channel) |
| Wetted Perimeter = | 16.00 | lf (assume 8'w x 4'h channel) |
| Channel Velocity = | 4.55 | ft/sec |
| *Segment Time =* | *13.65* | *minutes* |

| | | |
|---|---|---|
| **Time of Concentration =** | 48.15 | minutes |
| **SCS Lag Time =** | 28.89 | minutes (SCS Lag = 0.6* Tc) |
| **Time Increment =** | 8.38 | minutes (= 0.29*SCS Lag) |

THE POINT
AWH-20000

**PRE-DEVELOPMENT HYDROLOGY**
*Subbasin 6*

L. KABRICH, EI
6/18/2020

| Land Use | HSG | CN | Onsite | Percent Impervious (%) | Impervious Area (ac) | Area (ac) |
|---|---|---|---|---|---|---|
| Trail | D | 89 | Yes | 100 | 0.16 | 0.16 |
| Wooded | A | 30 | Yes | 0 | 0.00 | 0.37 |
| Wooded | D | 77 | Yes | 0 | 0.00 | 8.04 |

| | |
|---|---|
| **Total Area** | 8.56 ac |
| **Total Impervious Area** | 0.16 ac |
| **Onsite Area** | 8.56 ac |
| **Onsite Impervious Area** | 0.16 ac |
| **Percent Impervious** | 2 % |
| **Composite Curve Number** | 75 |

**Time of Concentration Information**
*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

*Segment 1: Overland Flow*

| | | |
|---|---|---|
| Length = | 100 | ft |
| Top Elev = | 386.00 | ft |
| Bot Elev = | 380.00 | ft |
| Height = | 6 | ft |
| Slope = | 0.0600 | ft/ft |
| Manning's n = | 0.40 | wooded |
| P (2-year/24-hour) = | 3.46 | inches (Rolesville, NC) |
| *Segment Time =* | *13.31* | *minutes* |

*Segment 2: Concentrated Flow*

| | | |
|---|---|---|
| Length = | 599 | ft |
| Top Elev = | 380.00 | ft |
| Bot Elev = | 288.00 | ft |
| Height = | 92 | ft |
| Slope = | 0.1536 | ft/ft |
| Paved ? = | No | |
| Velocity = | 6.32 | ft/sec |
| *Segment Time =* | *1.58* | *minutes* |

| | | |
|---|---|---|
| **Time of Concentration =** | 14.89 | minutes |
| **SCS Lag Time =** | 8.93 | minutes (SCS Lag = 0.6* Tc) |
| **Time Increment =** | 2.59 | minutes (= 0.29*SCS Lag) |

**PRE-DEVELOPMENT HYDROLOGY**
*Subbasin 7*

| Land Use | HSG | CN | Onsite | Percent Impervious (%) | Impervious Area (ac) | Area (ac) |
|----------|-----|-----|--------|------------------------|----------------------|-----------|
| Open | A | 39 | Yes | 0 | 0.00 | 0.70 |
| Open | B | 61 | Yes | 0 | 0.00 | 1.00 |
| Open | D | 80 | Yes | 0 | 0.00 | 0.06 |
| Trail | B | 82 | Yes | 100 | 0.15 | 0.15 |
| Wooded | A | 30 | Yes | 0 | 0.00 | 0.66 |
| Wooded | B | 55 | Yes | 0 | 0.00 | 7.85 |
| Wooded | D | 77 | Yes | 0 | 0.00 | 5.24 |

| | | |
|---|---|---|
| **Total Area** | 15.67 | ac |
| **Total Impervious Area** | 0.15 | ac |
| **Onsite Area** | 15.67 | ac |
| **Onsite Impervious Area** | 0.15 | ac |
| **Percent Impervious** | 1 | % |
| **Composite Curve Number** | 61 | |

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

*Segment 1: Overland Flow*

| | | |
|---|---|---|
| Length = | 100 | ft |
| Top Elev = | 418.00 | ft |
| Bot Elev = | 417.00 | ft |
| Height = | 1 | ft |
| Slope = | 0.0100 | ft/ft |
| Manning's n = | 0.24 | dense grasses |
| P (2-year/24-hour) = | 3.46 | inches (Rolesville, NC) |
| *Segment Time =* | *18.11* | *minutes* |

*Segment 2: Concentrated Flow*

| | | |
|---|---|---|
| Length = | 591 | ft |
| Top Elev = | 417.00 | ft |
| Bot Elev = | 338.00 | ft |
| Height = | 79 | ft |
| Slope = | 0.1337 | ft/ft |
| Paved ? = | No | |
| Velocity = | 5.90 | ft/sec |
| *Segment Time =* | *1.67* | *minutes* |

*Segment 3: Channel Flow*

| | | |
|---|---|---|
| Length = | 285 | ft |
| Top Elev = | 338.00 | ft |
| Bot Elev = | 324.00 | ft |
| Height = | 14 | ft |
| Slope = | 0.0491 | ft/ft |
| Manning's n = | 0.045 | natural channel |
| Flow Area = | 10.00 | sf (assume 5'w x 2'h channel) |
| Wetted Perimeter = | 9.00 | lf (assume 5'w x 2'h channel) |
| Channel Velocity = | 7.87 | ft/sec |
| *Segment Time =* | *0.60* | *minutes* |

| | | |
|---|---|---|
| **Time of Concentration =** | 20.38 | minutes |
| **SCS Lag Time =** | 12.23 | minutes (SCS Lag = 0.6* Tc) |
| **Time Increment =** | 3.55 | minutes (= 0.29*SCS Lag) |

THE POINT
AWH-20000

**PRE-DEVELOPMENT HYDROLOGY**
*Subbasin 8*

L. KABRICH, EI
6/18/2020

| Land Use | HSG | CN | Onsite | Percent Impervious (%) | Impervious Area (ac) | Area (ac) |
|---|---|---|---|---|---|---|
| Open | A | 39 | Yes | 0 | 0.00 | 0.67 |
| Open | B | 61 | Yes | 0 | 0.00 | 1.24 |
| Open | D | 80 | Yes | 0 | 0.00 | 0.02 |
| Trail | A | 72 | Yes | 100 | 0.04 | 0.04 |
| Trail | B | 82 | Yes | 100 | 0.07 | 0.07 |
| Wooded | A | 30 | Yes | 0 | 0.00 | 0.71 |
| Wooded | B | 55 | Yes | 0 | 0.00 | 3.22 |
| Wooded | D | 77 | Yes | 0 | 0.00 | 0.26 |

| | | |
|---|---|---|
| **Total Area** | 6.23 | ac |
| **Total Impervious Area** | 0.11 | ac |
| **Onsite Area** | 6.23 | ac |
| **Onsite Impervious Area** | 0.11 | ac |
| **Percent Impervious** | 2 | % |
| **Composite Curve Number** | 53 | |

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

*Segment 1: Overland Flow*

| | | |
|---|---|---|
| Length = | 100 | ft |
| Top Elev = | 398.00 | ft |
| Bot Elev = | 393.00 | ft |
| Height = | 5 | ft |
| Slope = | 0.0500 | ft/ft |
| Manning's n = | 0.24 | dense grasses |
| P (2-year/24-hour) = | 3.46 | inches (Rolesville, NC) |
| **Segment Time =** | **9.51** | **minutes** |

*Segment 2: Concentrated Flow*

| | | |
|---|---|---|
| Length = | 697 | ft |
| Top Elev = | 393.00 | ft |
| Bot Elev = | 365.00 | ft |
| Height = | 28 | ft |
| Slope = | 0.0402 | ft/ft |
| Paved ? = | No | |
| Velocity = | 3.23 | ft/sec |
| **Segment Time =** | **3.59** | **minutes** |

| | | |
|---|---|---|
| **Time of Concentration =** | 13.10 | minutes |
| **SCS Lag Time =** | 7.86 | minutes (SCS Lag = 0.6* Tc) |
| **Time Increment =** | 2.28 | minutes (= 0.29*SCS Lag) |

AWH20000.ppc
6/16/2020

27 Siemon Company Drive Suite 200 W  Watertown, CT
06795 USA  +1-203-755-1666

L. Kabrich, EI
McAdams

# MCADAMS
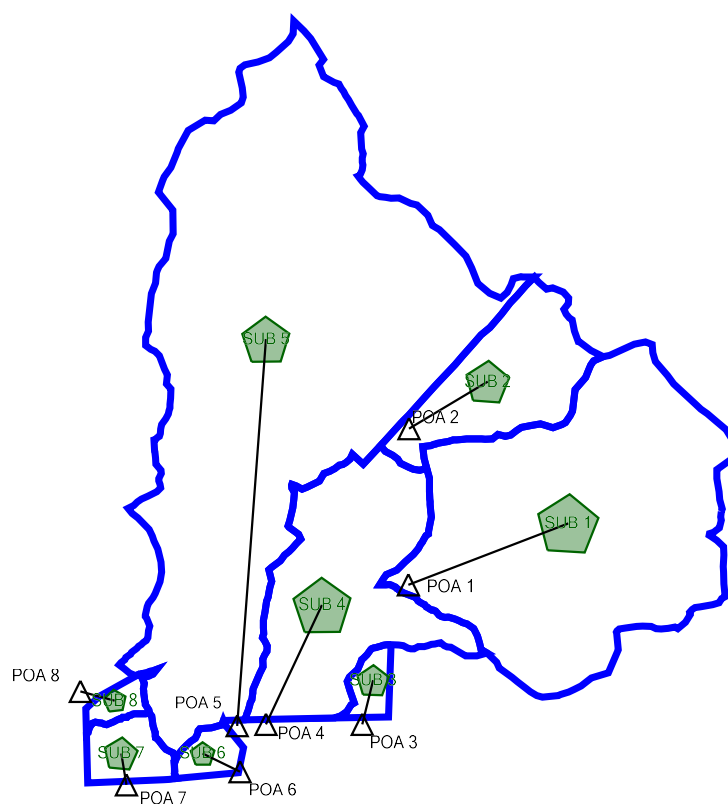
## FlexTable: Catchment
## Table (AWH20000.ppc)

### Current Time:  0.00 min

| Notes | Label | Area (User Defined) (acres) | SCS CN | Time of Concentration (min) |
|---|---|---|---|---|
| PRE | SUB 1 | 236.88 | 89.0 | 40.80 |
| PRE | SUB 2 | 59.90 | 87.0 | 31.12 |
| PRE | SUB 3 | 8.11 | 76.0 | 15.64 |
| PRE | SUB 4 | 108.57 | 78.0 | 33.28 |
| PRE | SUB 5 | 424.89 | 84.0 | 48.15 |
| PRE | SUB 6 | 8.56 | 75.0 | 14.89 |
| PRE | SUB 7 | 15.67 | 61.0 | 20.38 |
| PRE | SUB 8 | 6.23 | 53.0 | 13.10 |

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6/18/2020

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L. Kabrich, EI
McAdams

## Catchments Summary

| Label | Scenario | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (min) | Peak Flow (ft³/s) |
|---|---|---|---|---|---|
| SUB 1 | Pre-Dev 1 yr | 1 | 34.657 | 745.00 | 283.5 |
| SUB 1 | Pre-Dev 10 yr | 10 | 74.868 | 745.00 | 545.3 |
| SUB 2 | Pre-Dev 1 yr | 1 | 8.007 | 739.00 | 77.3 |
| SUB 2 | Pre-Dev 10 yr | 10 | 17.950 | 738.00 | 153.0 |
| SUB 5 | Pre-Dev 1 yr | 1 | 48.954 | 751.00 | 359.7 |
| SUB 5 | Pre-Dev 10 yr | 10 | 116.278 | 751.00 | 787.2 |
| SUB 4 | Pre-Dev 1 yr | 1 | 9.218 | 741.00 | 80.9 |
| SUB 4 | Pre-Dev 10 yr | 10 | 24.755 | 741.00 | 204.9 |
| SUB 7 | Pre-Dev 1 yr | 1 | 0.405 | 737.00 | 2.4 |
| SUB 7 | Pre-Dev 10 yr | 10 | 1.820 | 733.00 | 17.2 |
| SUB 8 | Pre-Dev 1 yr | 1 | 0.061 | 754.00 | 0.2 |
| SUB 8 | Pre-Dev 10 yr | 10 | 0.458 | 729.00 | 4.3 |
| SUB 6 | Pre-Dev 1 yr | 1 | 0.618 | 729.00 | 8.3 |
| SUB 6 | Pre-Dev 10 yr | 10 | 1.774 | 728.00 | 22.0 |
| SUB 3 | Pre-Dev 1 yr | 1 | 0.620 | 730.00 | 8.2 |
| SUB 3 | Pre-Dev 10 yr | 10 | 1.739 | 728.00 | 21.2 |

## Node Summary

| Label | Scenario | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (min) | Peak Flow (ft³/s) |
|---|---|---|---|---|---|
| POA 1 | Pre-Dev 1 yr | 1 | 34.657 | 745.00 | 283.5 |
| POA 1 | Pre-Dev 10 yr | 10 | 74.868 | 745.00 | 545.3 |
| POA 3 | Pre-Dev 1 yr | 1 | 0.620 | 730.00 | 8.2 |
| POA 3 | Pre-Dev 10 yr | 10 | 1.739 | 728.00 | 21.2 |
| POA 4 | Pre-Dev 1 yr | 1 | 9.218 | 741.00 | 80.9 |
| POA 4 | Pre-Dev 10 yr | 10 | 24.755 | 741.00 | 204.9 |
| POA 5 | Pre-Dev 1 yr | 1 | 48.954 | 751.00 | 359.7 |
| POA 5 | Pre-Dev 10 yr | 10 | 116.278 | 751.00 | 787.2 |
| POA 6 | Pre-Dev 1 yr | 1 | 0.618 | 729.00 | 8.3 |
| POA 6 | Pre-Dev 10 yr | 10 | 1.774 | 728.00 | 22.0 |
| POA 7 | Pre-Dev 1 yr | 1 | 0.405 | 737.00 | 2.4 |
| POA 7 | Pre-Dev 10 yr | 10 | 1.820 | 733.00 | 17.2 |
| POA 8 | Pre-Dev 1 yr | 1 | 0.061 | 754.00 | 0.2 |
| POA 8 | Pre-Dev 10 yr | 10 | 0.458 | 729.00 | 4.3 |
| POA 2 | Pre-Dev 1 yr | 1 | 8.007 | 739.00 | 77.3 |
| POA 2 | Pre-Dev 10 yr | 10 | 17.950 | 738.00 | 153.0 |

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6/18/2020

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McAdams
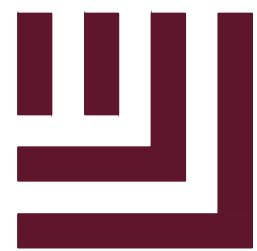
MCADAMS

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PHASES 1-10 AND 14**
PRELIMINARY PLAT PLANS
EAST YOUNG STREET
TOWN OF ROLESVILLE, WAKE FOREST TOWNSHIP,
WAKE COUNTY, NORTH CAROLINA

POA 2

SUBBASIN 5
AREA = 424.89 AC

SUBBASIN 2
AREA = 59.90 AC

SUBBASIN 4
AREA = 108.57 AC

SUBBASIN 1
AREA = 236.88 AC

TC PATH

TC PATH

TC PATH

POA 8

POA 1

SUBBASIN 8
AREA = 6.23 AC

SUBBASIN 3
AREA = 8.11 AC

POA 4

POA 3

POA 5

SUBBASIN 7
AREA = 15.67 AC

POA 6

POA 7

SUBBASIN 6
AREA = 8.56 AC

**REVISIONS**

NO.    DATE
1    04. 09. 2020    REV PER TOWN COMMENTS

**PLAN INFORMATION**

PROJECT NO.    AWH-20000
FILENAME    AWH-20000 PRE
CHECKED BY    DCW
DRAWN BY    LK
SCALE    1" = 450'
DATE    06.19.2020

**SHEET**

PRE DEVELOPMENT
HYDROLOGY MAP

**PRE**

GRAPHIC SCALE
0    225    450    900

1 inch = 450 ft.

N

*POST-DEVELOPMENT
HYDROLOGIC CALCULATIONS*

**The Point**
AWH-20000

THE POINTE
AWH20000

**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 1 to SCM A*

T. DABOLT
8/2/2021

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|-----|------|--------|-------|----------|------|-------|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 0

**II. ONSITE SCS CURVE NUMBERS - LOTS**

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|-----|--------------|-------------------|-------------------|-------------------|-------------------|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

**IV. ONSITE AREAS - LAND COVER**

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|-----|------|--------------|--------------|-----------------|------|--------------|
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 90833 | 0 | 86247 | 24577 | 11367 | 4630 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 72662 | 0 | 26709 | 8971 | 0 | 9 |

**V. ONSITE AREAS - LOTS**

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|-----|-----------|----------------|----------------|----------------|----------------|
| A | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 84208 | 0 | 23114 |
| B/D | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 6862 | 0 | 0 |

**VI. OFFSITE AREAS - ZONING**

| HSG | 90% impervious Right of Way | 30% impervious High Density Residential | 25% impervious Medium Density Residential | 20% impervious Low Density Residential | 85% impervious Commercial | 65% impervious Mixed Use Neighborhood | 85% impervious Business Park | 0% impervious Preserved Open Space | 85% impervious Town Center | 72% impervious School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 186 | 0 | 0 | 0 | 0 | 78952 | 0 | 0 | 0 | 0 |

THE POINTE
AWH20000

**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 1 to SCM A*

T. DABOLT
8/2/2021

**VII. LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 0 | 0 | 0 | 0 |
| SingleFamily39 | 0 | 0 | 0 | 0 |
| SingleFamily40 | 56,464 | 39,525 | 5,646 | 11,293 |
| SingleFamily50 | 0 | 0 | 0 | 0 |
| SingleFamily60 | 11,557 | 8,090 | 1,156 | 2,311 |
| *Totals* | 68,021 | 47,614 | 6,802 | 13,604 |

**VIII. TOTAL DRAINAGE AREA RESULT**

| | | |
|---|---|---|
| Total Area per GIS Calc = | 11.92 | acres |
| | **519328** | sf |
| | | |
| Composite SCS CN = | 85 | |
| Total Impervious Area = | **266011** | sf |
| | | |
| % Impervious = | 51.2% | |

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

| | | |
|---|---|---|
| Time of Concentration = | 5.00 | minutes |
| SCS Lag Time = | 3.00 | minutes (SCS Lag = 0.6* Tc) |
| Time Increment = | 0.87 | minutes (= 0.29*SCS Lag) |

THE POINTE
AWH20000

**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 1 to SCM B*

T. DABOLT
8/2/2021

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|-----|------|--------|-------|----------|------|-------|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 15

**II. ONSITE SCS CURVE NUMBERS - LOTS**

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|-----|--------------|-------------------|-------------------|-------------------|-------------------|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

**IV. ONSITE AREAS - LAND COVER**

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|-----|------|---------------|--------------|-----------------|------|--------------|
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 71700 | 0 | 28982 | 8643 | 5484 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 58586 | 0 | 39271 | 10383 | 3169 | 0 |

**V. ONSITE AREAS - LOTS**

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|-----|------------|----------------|----------------|----------------|----------------|
| A | 0 | 0 | 0 | 0 | 0 |
| B | 67910 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 |
| D | 66566 | 0 | 0 | 0 | 0 |

**VI. OFFSITE AREAS - ZONING**

| | *90% impervious* | *30% impervious* | *25% impervious* | *20% impervious* | *85% impervious* | *65% impervious* | *85% impervious* | *0% impervious* | *85% impervious* | *72% impervious* |
|-----|------|------|------|------|------|------|------|------|------|------|
| HSG | Right of Way | High Density Residential | Medium Density Residential | Low Density Residential | Commercial | Mixed Use Neighborhood | Business Park | Preserved Open Space | Town Center | School |
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 1697 | 0 | 0 | 0 | 0 | 70164 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 559 | 0 | 0 | 0 | 0 | 13932 | 0 | 0 | 0 | 0 |

THE POINTE
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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 1 to SCM B*

T. DABOLT
8/2/2021

**VII.  LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 122,251 | 85,576 | 12,225 | 24,450 |
| SingleFamily39 | 0 | 0 | 0 | 0 |
| SingleFamily40 | 0 | 0 | 0 | 0 |
| SingleFamily50 | 0 | 0 | 0 | 0 |
| SingleFamily60 | 0 | 0 | 0 | 0 |
| *Totals* | 122,251 | 85,576 | 12,225 | 24,450 |

**VIII.  TOTAL DRAINAGE AREA RESULT**

| | | |
|---|---|---|
| Total Area per GIS Calc = | 10.26 | acres |
| | **447048** | sf |
| | | |
| Composite SCS CN = | 87 | |
| Total Impervious Area = | **266224** | sf |
| | | |
| % Impervious = | 59.6% | |

**IX.  TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

| | | |
|---|---|---|
| Time of Concentration = | 5.00 | minutes |
| SCS Lag Time = | 3.00 | minutes (SCS Lag = 0.6* Tc) |
| Time Increment = | 0.87 | minutes (= 0.29*SCS Lag) |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 1 to SCM C*

T. DABOLT
8/2/2021

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|-----|------|--------|-------|----------|------|-------|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 14

**II. ONSITE SCS CURVE NUMBERS - LOTS**

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|-----|--------------|-------------------|-------------------|-------------------|-------------------|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

**IV. ONSITE AREAS - LAND COVER**

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|-----|------|---------------|--------------|-----------------|------|--------------|
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 61769 | 0 | 73235 | 21972 | 1330 | 804 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 51459 | 0 | 40559 | 12919 | 13788 | 88 |

**V. ONSITE AREAS - LOTS**

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|-----|-----------|----------------|----------------|----------------|----------------|
| A | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 90183 | 141800 | 0 | 43514 |
| B/D | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 79639 | 39449 | 0 | 10628 |

**VI. OFFSITE AREAS - ZONING**

| | *90% impervious* | *30% impervious* | *25% impervious* | *20% impervious* | *85% impervious* | *65% impervious* | *85% impervious* | *0% impervious* | *85% impervious* | *72% impervious* |
|-----|------|------|------|------|------|------|------|------|------|------|
| HSG | Right of Way | High Density Residential | Medium Density Residential | Low Density Residential | Commercial | Mixed Use Neighborhood | Business Park | Preserved Open Space | Town Center | School |
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 1 to SCM C*

T. DABOLT
8/2/2021

**VII. LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 0 | 0 | 0 | 0 |
| SingleFamily39 | 109,806 | 76,864 | 10,981 | 21,961 |
| SingleFamily40 | 112,374 | 78,662 | 11,237 | 22,475 |
| SingleFamily50 | 0 | 0 | 0 | 0 |
| SingleFamily60 | 27,071 | 18,950 | 2,707 | 5,414 |
| *Totals* | **249,251** | 174,476 | 24,925 | 49,850 |

**VIII. TOTAL DRAINAGE AREA RESULT**

| | | |
|---|---|---|
| Total Area per GIS Calc = | 15.68 | acres |
| | **683134** | sf |
| | | |
| Composite SCS CN = | 86 | |
| Total Impervious Area = | **397936** | sf |
| | | |
| % Impervious = | 58.3% | |

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

| | | |
|---|---|---|
| Time of Concentration = | 5.00 | minutes |
| SCS Lag Time = | 3.00 | minutes (SCS Lag = 0.6* Tc) |
| Time Increment = | 0.87 | minutes (= 0.29*SCS Lag) |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 1 to SCM E*

T. DABOLT
8/2/2021

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|-----|------|--------|-------|----------|------|-------|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 13

**II. ONSITE SCS CURVE NUMBERS - LOTS**

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|-----|--------------|-------------------|-------------------|-------------------|-------------------|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

**IV. ONSITE AREAS - LAND COVER**

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|-----|------|---------------|--------------|-----------------|------|--------------|
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 45141 | 0 | 59630 | 16037 | 8728 | 1677 |
| B/D | 5822 | 0 | 3836 | 1966 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 45560 | 0 | 60659 | 16233 | 15434 | 3379 |

**V. ONSITE AREAS - LOTS**

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|-----|------------|----------------|----------------|----------------|----------------|
| A | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 57697 | 98197 | 0 | 86974 |
| B/D | 0 | 0 | 1650 | 0 | 22691 |
| C | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 49507 | 101286 | 0 | 55579 |

**VI. OFFSITE AREAS - ZONING**

| HSG | 90% impervious Right of Way | 30% impervious High Density Residential | 25% impervious Medium Density Residential | 20% impervious Low Density Residential | 85% impervious Commercial | 65% impervious Mixed Use Neighborhood | 85% impervious Business Park | 0% impervious Preserved Open Space | 85% impervious Town Center | 72% impervious School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 1 to SCM E*

T. DABOLT
8/2/2021

**VII. LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 0 | 0 | 0 | 0 |
| SingleFamily39 | 69,318 | 48,523 | 6,932 | 13,864 |
| SingleFamily40 | 124,702 | 87,292 | 12,470 | 24,940 |
| SingleFamily50 | 0 | 0 | 0 | 0 |
| SingleFamily60 | 82,622 | 57,836 | 8,262 | 16,524 |
| *Totals* | 276,643 | 193,650 | 27,664 | 55,329 |

**VIII. TOTAL DRAINAGE AREA RESULT**

|  |  |  |
|---|---|---|
| Total Area per GIS Calc = | 17.39 | acres |
|  | **757683** | sf |
|  |  |  |
| Composite SCS CN = | 87 |  |
| Total Impervious Area = | **435004** | sf |
|  |  |  |
| % Impervious = | 57.4% |  |

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

|  |  |  |
|---|---|---|
| Time of Concentration = | 5.00 | minutes |
| SCS Lag Time = | 3.00 | minutes (SCS Lag = 0.6* Tc) |
| Time Increment = | 0.87 | minutes (= 0.29*SCS Lag) |

**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 1 to SCM D*

### I. ONSITE SCS CURVE NUMBERS - LAND COVER

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|-----|------|--------|-------|----------|------|-------|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 16

### II. ONSITE SCS CURVE NUMBERS - LOTS

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|-----|--------------|-------------------|-------------------|-------------------|-------------------|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

### III. OFFSITE SCS CURVE NUMBERS - ZONING

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

### IV. ONSITE AREAS - LAND COVER

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|-----|------|---------------|--------------|-----------------|------|--------------|
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 70779 | 0 | 71986 | 24952 | 19528 | 0 |
| B/D | 3050 | 0 | 2654 | 905 | 85 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 487 | 0 | 383 | 379 | 0 | 0 |

### V. ONSITE AREAS - LOTS

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|-----|-----------|----------------|----------------|----------------|----------------|
| A | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 362575 |
| B/D | 0 | 0 | 0 | 0 | 17129 |
| C | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 13 |

### VI. OFFSITE AREAS - ZONING

| | 90% impervious | 30% impervious | 25% impervious | 20% impervious | 85% impervious | 65% impervious | 85% impervious | 0% impervious | 85% impervious | 72% impervious |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| HSG | Right of Way | High Density Residential | Medium Density Residential | Low Density Residential | Commercial | Mixed Use Neighborhood | Business Park | Preserved Open Space | Town Center | School |
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 1 to SCM D*

T. DABOLT
8/2/2021

**VII. LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 0 | 0 | 0 | 0 |
| SingleFamily39 | 0 | 0 | 0 | 0 |
| SingleFamily40 | 0 | 0 | 0 | 0 |
| SingleFamily50 | 0 | 0 | 0 | 0 |
| SingleFamily60 | 189,859 | 132,901 | 18,986 | 37,972 |
| *Totals* | 189,859 | 132,901 | 18,986 | 37,972 |

**VIII. TOTAL DRAINAGE AREA RESULT**

| | | |
|---|---|---|
| Total Area per GIS Calc = | 13.20 | acres |
| | **574905** | sf |
| | | |
| Composite SCS CN = | 81 | |
| Total Impervious Area = | **291118** | sf |
| | | |
| % Impervious = | 50.6% | |

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

| | | |
|---|---|---|
| Time of Concentration = | 5.00 | minutes |
| SCS Lag Time = | 3.00 | minutes (SCS Lag = 0.6* Tc) |
| Time Increment = | 0.87 | minutes (= 0.29*SCS Lag) |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 4 to SCM F*

T. DABOLT
8/2/2021

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|-----|------|--------|-------|----------|------|-------|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 12

**II. ONSITE SCS CURVE NUMBERS - LOTS**

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|-----|--------------|-------------------|-------------------|-------------------|-------------------|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

**IV. ONSITE AREAS - LAND COVER**

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|-----|------|---------------|--------------|-----------------|------|--------------|
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 53424 | 0 | 51366 | 13332 | 0 | 4318 |
| B/D | 116287 | 0 | 34711 | 12924 | 47 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 65895 | 0 | 40542 | 13681 | 16065 | 0 |

**V. ONSITE AREAS - LOTS**

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|-----|------------|----------------|----------------|----------------|----------------|
| A | 0 | 0 | 0 | 0 | 0 |
| B | 10184 | 90465 | 85971 | 0 | 0 |
| B/D | 17316 | 25633 | 12370 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 |
| D | 39125 | 11973 | 73531 | 0 | 26072 |

**VI. OFFSITE AREAS - ZONING**

| HSG | 90% impervious Right of Way | 30% impervious High Density Residential | 25% impervious Medium Density Residential | 20% impervious Low Density Residential | 85% impervious Commercial | 65% impervious Mixed Use Neighborhood | 85% impervious Business Park | 0% impervious Preserved Open Space | 85% impervious Town Center | 72% impervious School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 4 to SCM F*

T. DABOLT
8/2/2021

**VII. LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 60,568 | 42,398 | 6,057 | 12,114 |
| SingleFamily39 | 82,811 | 57,968 | 8,281 | 16,562 |
| SingleFamily40 | 106,560 | 74,592 | 10,656 | 21,312 |
| SingleFamily50 | 0 | 0 | 0 | 0 |
| SingleFamily60 | 13,036 | 9,125 | 1,304 | 2,607 |
| *Totals* | 262,975 | 184,083 | 26,298 | 52,595 |

**VIII. TOTAL DRAINAGE AREA RESULT**

| | | |
|---|---|---|
| Total Area per GIS Calc = | 18.72 | acres |
| | **815231** | sf |
| | | |
| Composite SCS CN = | 87 | |
| Total Impervious Area = | **429531** | sf |
| | | |
| % Impervious = | 52.7% | |

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

| | | |
|---|---|---|
| Time of Concentration = | 5.00 | minutes |
| SCS Lag Time = | 3.00 | minutes (SCS Lag = 0.6* Tc) |
| Time Increment = | 0.87 | minutes (= 0.29*SCS Lag) |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 4 to SCM G*

T. DABOLT
8/2/2021

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|-----|------|--------|-------|----------|------|-------|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 8

**II. ONSITE SCS CURVE NUMBERS - LOTS**

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|-----|--------------|-------------------|-------------------|-------------------|-------------------|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

**IV. ONSITE AREAS - LAND COVER**

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|-----|------|---------------|--------------|-----------------|------|--------------|
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 40011 | 0 | 31008 | 11259 | 0 | 0 |
| B/D | 20490 | 0 | 17445 | 4418 | 1288 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 94972 | 0 | 52042 | 17274 | 14545 | 0 |

**V. ONSITE AREAS - LOTS**

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|-----|------------|----------------|----------------|----------------|----------------|
| A | 0 | 0 | 0 | 0 | 0 |
| B | 56568 | 0 | 0 | 25474 | 0 |
| B/D | 1586 | 0 | 0 | 6060 | 0 |
| C | 0 | 0 | 0 | 0 | 0 |
| D | 103079 | 0 | 0 | 97575 | 0 |

**VI. OFFSITE AREAS - ZONING**

| | 90% impervious | 30% impervious | 25% impervious | 20% impervious | 85% impervious | 65% impervious | 85% impervious | 0% impervious | 85% impervious | 72% impervious |
|-----|------|------|------|------|------|------|------|------|------|------|
| HSG | Right of Way | High Density Residential | Medium Density Residential | Low Density Residential | Commercial | Mixed Use Neighborhood | Business Park | Preserved Open Space | Town Center | School |
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 4 to SCM G*

T. DABOLT
8/2/2021

**VII. LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 146,576 | 102,603 | 14,658 | 29,315 |
| SingleFamily39 | 0 | 0 | 0 | 0 |
| SingleFamily40 | 0 | 0 | 0 | 0 |
| SingleFamily50 | 75,576 | 52,903 | 7,558 | 15,115 |
| SingleFamily60 | 0 | 0 | 0 | 0 |
| *Totals* | 222,152 | 155,506 | 22,215 | 44,430 |

**VIII. TOTAL DRAINAGE AREA RESULT**

|  |  |  |
|---|---|---|
| Total Area per GIS Calc = | 13.66 | acres |
|  | **595094** | sf |
|  |  |  |
| Composite SCS CN = | 90 |  |
| Total Impervious Area = | **355598** | sf |
|  |  |  |
| % Impervious = | 59.8% |  |

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

|  |  |  |
|---|---|---|
| Time of Concentration = | 5.00 | minutes |
| SCS Lag Time = | 3.00 | minutes (SCS Lag = 0.6* Tc) |
| Time Increment = | 0.87 | minutes (= 0.29*SCS Lag) |

**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 4 to SCM H*

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|-----|------|--------|-------|----------|------|-------|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 6

**II. ONSITE SCS CURVE NUMBERS - LOTS**

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|-----|--------------|-------------------|-------------------|-------------------|-------------------|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|-----|--------------|------------------------------|-----------------------------|---------------------------|---------------------|--------------------------|------------------------|-------------------------|-------------|--------|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

**IV. ONSITE AREAS - LAND COVER**

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|-----|------|---------------|--------------|-----------------|------|--------------|
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 |
| B/D | 9097 | 0 | 12526 | 3521 | 0 | 0 |
| C | 41860 | 73 | 56870 | 17719 | 0 | 0 |
| D | 47299 | 9384 | 30675 | 8063 | 17405 | 0 |

**V. ONSITE AREAS - LOTS**

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|-----|------------|----------------|----------------|----------------|----------------|
| A | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 17962 | 0 |
| C | 0 | 0 | 0 | 336019 | 0 |
| D | 0 | 0 | 0 | 106065 | 0 |

**VI. OFFSITE AREAS - ZONING**

| | 90% impervious | 30% impervious | 25% impervious | 20% impervious | 85% impervious | 65% impervious | 85% impervious | 0% impervious | 85% impervious | 72% impervious |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------|----------------|----------------|
| HSG | Right of Way | High Density Residential | Medium Density Residential | Low Density Residential | Commercial | Mixed Use Neighborhood | Business Park | Preserved Open Space | Town Center | School |
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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**POST-DEVELOPMENT HYDROLOGY**  
*Subbasin Sub 4 to SCM H*

T. DABOLT  
8/2/2021

**VII. LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 0 | 0 | 0 | 0 |
| SingleFamily39 | 0 | 0 | 0 | 0 |
| SingleFamily40 | 0 | 0 | 0 | 0 |
| SingleFamily50 | 269,295 | 188,507 | 26,930 | 53,859 |
| SingleFamily60 | 0 | 0 | 0 | 0 |
| *Totals* | 269,295 | 188,507 | 26,930 | 53,859 |

**VIII. TOTAL DRAINAGE AREA RESULT**

| | | |
|---|---|---|
| Total Area per GIS Calc = | 16.40 | acres |
| | **714538** | sf |
| | | |
| Composite SCS CN = | 89 | |
| Total Impervious Area = | **398669** | sf |
| | | |
| % Impervious = | 55.8% | |

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

| | | |
|---|---|---|
| Time of Concentration = | 5.00 | minutes |
| SCS Lag Time = | 3.00 | minutes (SCS Lag = 0.6* Tc) |
| Time Increment = | 0.87 | minutes (= 0.29*SCS Lag) |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 4 to SCM I*

T. DABOLT
8/2/2021

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|-----|------|--------|-------|----------|------|-------|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 7

**II. ONSITE SCS CURVE NUMBERS - LOTS**

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|-----|--------------|-------------------|-------------------|-------------------|-------------------|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

**IV. ONSITE AREAS - LAND COVER**

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|-----|------|---------------|--------------|-----------------|------|--------------|
| A | 6505 | 0 | 11402 | 4011 | 0 | 0 |
| B | 1734 | 0 | 3686 | 1333 | 0 | 0 |
| B/D | 113 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 57013 | 0 | 33703 | 11780 | 7845 | 0 |

**V. ONSITE AREAS - LOTS**

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|-----|------------|----------------|----------------|----------------|----------------|
| A | 0 | 0 | 0 | 39602 | 0 |
| B | 0 | 0 | 0 | 30142 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 155736 | 0 |

**VI. OFFSITE AREAS - ZONING**

| | *90% impervious* | *30% impervious* | *25% impervious* | *20% impervious* | *85% impervious* | *65% impervious* | *85% impervious* | *0% impervious* | *85% impervious* | *72% impervious* |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| HSG | Right of Way | High Density Residential | Medium Density Residential | Low Density Residential | Commercial | Mixed Use Neighborhood | Business Park | Preserved Open Space | Town Center | School |
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 4 to SCM I*

T. DABOLT
8/2/2021

## VII. LOT BREAKDOWN

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 0 | 0 | 0 | 0 |
| SingleFamily39 | 0 | 0 | 0 | 0 |
| SingleFamily40 | 0 | 0 | 0 | 0 |
| SingleFamily50 | 131,988 | 92,391 | 13,199 | 26,398 |
| SingleFamily60 | 0 | 0 | 0 | 0 |
| *Totals* | 131,988 | 92,391 | 13,199 | 26,398 |

## VIII. TOTAL DRAINAGE AREA RESULT

| | | |
|---|---|---|
| Total Area per GIS Calc = | 8.37 | acres |
| | **364606** | sf |
| | | |
| Composite SCS CN = | 87 | |
| Total Impervious Area = | **197903** | sf |
| | | |
| % Impervious = | 54.3% | |

## IX. TIME OF CONCENTRATION

*Time of concentration is assumed to be 5 minutes.*

| | | |
|---|---|---|
| Time of Concentration = | 5.00 | minutes |
| SCS Lag Time = | 3.00 | minutes (SCS Lag = 0.6* Tc) |
| Time Increment = | 0.87 | minutes (= 0.29*SCS Lag) |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 5 to SCM J*

T. DABOLT
8/2/2021

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|-----|------|--------|-------|----------|------|-------|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 9

**II. ONSITE SCS CURVE NUMBERS - LOTS**

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|-----|--------------|-------------------|-------------------|-------------------|-------------------|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

**IV. ONSITE AREAS - LAND COVER**

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|-----|------|---------------|--------------|-----------------|------|--------------|
| A | 24271 | 0 | 8528 | 2982 | 0 | 0 |
| B | 27857 | 0 | 18300 | 5506 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 95003 | 64869 | 58724 | 17815 | 13690 | 0 |

**V. ONSITE AREAS - LOTS**

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|-----|------------|----------------|----------------|----------------|----------------|
| A | 0 | 0 | 0 | 46999 | 0 |
| B | 22302 | 0 | 0 | 18988 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 |
| D | 25619 | 0 | 0 | 166608 | 0 |

**VI. OFFSITE AREAS - ZONING**

| HSG | *90% impervious* Right of Way | *30% impervious* High Density Residential | *25% impervious* Medium Density Residential | *20% impervious* Low Density Residential | *85% impervious* Commercial | *65% impervious* Mixed Use Neighborhood | *85% impervious* Business Park | *0% impervious* Preserved Open Space | *85% impervious* Town Center | *72% impervious* School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 5 to SCM J*

T. DABOLT
8/2/2021

**VII.  LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 43,564 | 30,495 | 4,356 | 8,713 |
| SingleFamily39 | 0 | 0 | 0 | 0 |
| SingleFamily40 | 0 | 0 | 0 | 0 |
| SingleFamily50 | 136,153 | 95,307 | 13,615 | 27,231 |
| SingleFamily60 | 0 | 0 | 0 | 0 |
| *Totals* | 179,718 | 125,802 | 17,972 | 35,944 |

**VIII. TOTAL DRAINAGE AREA RESULT**

| | | |
|---|---|---|
| Total Area per GIS Calc = | 14.19 | acres |
| | **618061** | sf |
| | | |
| Composite SCS CN = | 85 | |
| Total Impervious Area = | **291573** | sf |
| | | |
| % Impervious = | 47.2% | |

**IX.  TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

| | | |
|---|---|---|
| Time of Concentration = | 5.00 | minutes |
| SCS Lag Time = | 3.00 | minutes (SCS Lag = 0.6* Tc) |
| Time Increment = | 0.87 | minutes (= 0.29*SCS Lag) |

**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 1 BYPASS*

### I. ONSITE SCS CURVE NUMBERS - LAND COVER

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|---|---|---|---|---|---|---|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 1

### II. ONSITE SCS CURVE NUMBERS - LOTS

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|---|---|---|---|---|---|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

### III. OFFSITE SCS CURVE NUMBERS - ZONING

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

### IV. ONSITE AREAS - LAND COVER

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|---|---|---|---|---|---|---|
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 454874 | 140808 | 7655 | 11691 | 4131 | 110741 |
| B/D | 38957 | 238736 | 0 | 0 | 1148 | 0 |
| C | 0 | 1512 | 0 | 0 | 0 | 0 |
| D | 159038 | 21927 | 29 | 174 | 295367 | 8174 |

### V. ONSITE AREAS - LOTS

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|---|---|---|---|---|---|
| A | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 13066 |
| B/D | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 2271 |

### VI. OFFSITE AREAS - ZONING

| HSG | 90% impervious<br>Right of Way | 30% impervious<br>High Density Residential | 25% impervious<br>Medium Density Residential | 20% impervious<br>Low Density Residential | 85% impervious<br>Commercial | 65% impervious<br>Mixed Use Neighborhood | 85% impervious<br>Business Park | 0% impervious<br>Preserved Open Space | 85% impervious<br>Town Center | 72% impervious<br>School |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 178555 | 0 | 49735 | 12823 | 0 | 532407 | 0 | 0 | 0 | 780297 |
| B/D | 16957 | 0 | 0 | 0 | 0 | 179660 | 0 | 0 | 0 | 369944 |
| C | 0 | 0 | 0 | 0 | 0 | 77938 | 0 | 0 | 0 | 0 |
| D | 153068 | 0 | 3316 | 985806 | 0 | 617428 | 0 | 0 | 0 | 2652145 |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 1 BYPASS*

T. DABOLT
8/2/2021

**VII. LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 0 | 0 | 0 | 0 |
| SingleFamily39 | 0 | 0 | 0 | 0 |
| SingleFamily40 | 0 | 0 | 0 | 0 |
| SingleFamily50 | 0 | 0 | 0 | 0 |
| SingleFamily60 | 7,668 | 5,368 | 767 | 1,534 |
| *Totals* | 7,668 | 5,368 | 767 | 1,534 |

**VIII. TOTAL DRAINAGE AREA RESULT**

| | | |
|---|---|---|
| Total Area per GIS Calc = | 186.42 | acres |
| | **8120377** | sf |
| | | |
| Composite SCS CN = | 87 | |
| Total Impervious Area = | **4206476** | sf |
| | | |
| % Impervious = | 51.8% | |

**IX. TIME OF CONCENTRATION**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

*Segment 1: Overland Flow*

| | | |
|---|---|---|
| Length = | 100 | ft |
| Top Elev = | 426.00 | ft |
| Bot Elev = | 425.00 | ft |
| Height = | 1 | ft |
| Slope = | 0.0100 | ft/ft |
| Manning's n = | 0.17 | cultivated soils, residue cover |
| P (2-year/24-hour) = | 3.46 | inches (Rolesville, NC) |
| *Segment Time =* | *13.74* | *minutes* |

*Segment 2: Concentrated Flow*

| | | |
|---|---|---|
| Length = | 2645 | ft |
| Top Elev = | 425.00 | ft |
| Bot Elev = | 374.00 | ft |
| Height = | 51 | ft |
| Slope = | 0.0193 | ft/ft |
| Paved ? = | No | |
| Velocity = | 2.24 | ft/sec |
| *Segment Time =* | *19.68* | *minutes* |

*Segment 3: Open Water Flow*

| | | |
|---|---|---|
| Length = | 580 | ft |
| Top Elev = | 374.00 | ft |
| Bot Elev = | 372.00 | ft |
| *Segment Time =* | *0.00* | *minutes* |

*Segment 4: Channel Flow*

| | | |
|---|---|---|
| Length = | 2088 | ft |
| Top Elev = | 372.00 | ft |
| Bot Elev = | 344.00 | ft |
| Height = | 28 | ft |
| Slope = | 0.0134 | ft/ft |
| Manning's n = | 0.045 | natural channel |
| Flow Area = | 15.00 | sf (assume 5'w x 3'h channel) |
| Wetted Perimeter = | 11.00 | lf (assume 5'w x 3'h channel) |
| Channel Velocity = | 4.72 | ft/sec |
| *Segment Time =* | *7.38* | *minutes* |

| | | |
|---|---|---|
| **Time of Concentration =** | 40.80 | minutes |
| **SCS Lag Time =** | 24.48 | minutes (SCS Lag = 0.6* Tc) |
| **Time Increment =** | 7.10 | minutes (= 0.29*SCS Lag) |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 2 BYPASS*

T. DABOLT
8/2/2021

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|-----|------|--------|-------|----------|------|-------|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 2

**II. ONSITE SCS CURVE NUMBERS - LOTS**

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|-----|--------------|-------------------|-------------------|-------------------|-------------------|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

**IV. ONSITE AREAS - LAND COVER**

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|-----|------|---------------|--------------|-----------------|------|--------------|
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 31858 | 19412 | 0 | 6260 | 0 | 22619 |
| B/D | 0 | 52628 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 22027 | 23834 | 0 | 3127 | 0 | 4670 |

**V. ONSITE AREAS - LOTS**

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|-----|-----------|----------------|----------------|----------------|----------------|
| A | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 17 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 0 |

**VI. OFFSITE AREAS - ZONING**

| | 90% impervious | 30% impervious | 25% impervious | 20% impervious | 85% impervious | 65% impervious | 85% impervious | 0% impervious | 85% impervious | 72% impervious |
|-----|------|------|------|------|------|------|------|------|------|------|
| HSG | Right of Way | High Density Residential | Medium Density Residential | Low Density Residential | Commercial | Mixed Use Neighborhood | Business Park | Preserved Open Space | Town Center | School |
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 100879 | 0 | 0 | 0 | 0 | 230704 | 0 | 0 | 0 | 0 |
| B/D | 37900 | 0 | 0 | 0 | 0 | 38861 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 442930 | 0 | 0 | 782428 | 0 | 543504 | 0 | 0 | 0 | 0 |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 2 BYPASS*

T. DABOLT
8/2/2021

**VII. LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 0 | 0 | 0 | 0 |
| SingleFamily39 | 11 | 8 | 1 | 2 |
| SingleFamily40 | 0 | 0 | 0 | 0 |
| SingleFamily50 | 0 | 0 | 0 | 0 |
| SingleFamily60 | 0 | 0 | 0 | 0 |
| *Totals* | 11 | 8 | 1 | 2 |

**VIII. TOTAL DRAINAGE AREA RESULT**

| | | |
|---|---|---|
| **Total Area per GIS Calc =** | 54.26 | acres |
| | **2363659** | sf |
| | | |
| **Composite SCS CN =** | 87 | |
| **Total Impervious Area =** | **1217917** | sf |
| | | |
| **% Impervious =** | 51.5% | |

**IX. TIME OF CONCENTRATION**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

| *Segment 1: Overland Flow* | | | | *Segment 2: Concentrated Flow* | | |
|---|---|---|---|---|---|---|
| Length = | 100 | ft | | Length = | 2541 | ft |
| Top Elev = | 427.00 | ft | | Top Elev = | 426.00 | ft |
| Bot Elev = | 426.00 | ft | | Bot Elev = | 368.00 | ft |
| Height = | 1 | ft | | Height = | 58 | ft |
| Slope = | 0.0100 | ft/ft | | Slope = | 0.0228 | ft/ft |
| Manning's n = | 0.17 | cultivated soils, residue cover | | Paved ? = | No | |
| P (2-year/24-hour) = | 3.46 | inches (Rolesville, NC) | | Velocity = | 2.44 | ft/sec |
| *Segment Time =* | *13.74* | *minutes* | | *Segment Time =* | *17.37* | *minutes* |

| | | |
|---|---|---|
| **Time of Concentration =** | 31.12 | minutes |
| **SCS Lag Time =** | 18.67 | minutes (SCS Lag = 0.6* Tc) |
| **Time Increment =** | 5.41 | minutes (= 0.29*SCS Lag) |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 3 BYPASS*

T. DABOLT
8/2/2021

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|-----|------|--------|-------|----------|------|-------|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 4

**II. ONSITE SCS CURVE NUMBERS - LOTS**

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|-----|--------------|-------------------|-------------------|-------------------|-------------------|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

**IV. ONSITE AREAS - LAND COVER**

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|-----|------|---------------|--------------|-----------------|------|--------------|
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 9831 | 10071 | 0 | 0 | 0 | 0 |
| D | 33156 | 180414 | 0 | 0 | 0 | 0 |

**V. ONSITE AREAS - LOTS**

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|-----|------------|----------------|----------------|----------------|----------------|
| A | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 54 | 0 |
| D | 0 | 0 | 0 | 916 | 0 |

**VI. OFFSITE AREAS - ZONING**

| HSG | 90% impervious Right of Way | 30% impervious High Density Residential | 25% impervious Medium Density Residential | 20% impervious Low Density Residential | 85% impervious Commercial | 65% impervious Mixed Use Neighborhood | 85% impervious Business Park | 0% impervious Preserved Open Space | 85% impervious Town Center | 72% impervious School |
|-----|------|------|------|------|------|------|------|------|------|------|
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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*Subbasin Sub 3 BYPASS*

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**VII. LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 0 | 0 | 0 | 0 |
| SingleFamily39 | 0 | 0 | 0 | 0 |
| SingleFamily40 | 0 | 0 | 0 | 0 |
| SingleFamily50 | 568 | 397 | 57 | 114 |
| SingleFamily60 | 0 | 0 | 0 | 0 |
| *Totals* | 568 | 397 | 57 | 114 |

**VIII. TOTAL DRAINAGE AREA RESULT**

| | | |
|---|---|---|
| Total Area per GIS Calc = | 5.38 | acres |
| | **234442** | sf |
| | | |
| Composite SCS CN = | 77 | |
| Total Impervious Area = | **568** | sf |
| | | |
| % Impervious = | 0.2% | |

**IX. TIME OF CONCENTRATION**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

*Segment 1: Overland Flow*

| | | |
|---|---|---|
| Length = | 100 | ft |
| Top Elev = | 368.00 | ft |
| Bot Elev = | 363.00 | ft |
| Height = | 5 | ft |
| Slope = | 0.0500 | ft/ft |
| Manning's n = | 0.24 | dense grasses |
| P (2-year/24-hour) = | 3.46 | inches (Rolesville, NC) |
| *Segment Time =* | *9.51* | *minutes* |

*Segment 2: Concentrated Flow*

| | | |
|---|---|---|
| Length = | 881 | ft |
| Top Elev = | 363.00 | ft |
| Bot Elev = | 336.00 | ft |
| Height = | 27 | ft |
| Slope = | 0.0306 | ft/ft |
| Paved ? = | No | |
| Velocity = | 2.82 | ft/sec |
| *Segment Time =* | *5.20* | *minutes* |

*Segment 3: Channel Flow*

| | | |
|---|---|---|
| Length = | 249 | ft |
| Top Elev = | 336.00 | ft |
| Bot Elev = | 333.00 | ft |
| Height = | 3 | ft |
| Slope = | 0.0120 | ft/ft |
| Manning's n = | 0.045 | natural channel |
| Flow Area = | 15.00 | sf (assume 5'w x 3'h channel) |
| Wetted Perimeter = | 11.00 | lf (assume 5'w x 3'h channel) |
| Channel Velocity = | 4.47 | ft/sec |
| *Segment Time =* | *0.93* | *minutes* |

| | | |
|---|---|---|
| Time of Concentration = | 15.64 | minutes |
| SCS Lag Time = | 9.38 | minutes (SCS Lag = 0.6* Tc) |
| Time Increment = | 2.72 | minutes (= 0.29*SCS Lag) |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 4 BYPASS*

T. DABOLT
8/2/2021

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|---|---|---|---|---|---|---|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 5

**II. ONSITE SCS CURVE NUMBERS - LOTS**

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|---|---|---|---|---|---|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

**IV. ONSITE AREAS - LAND COVER**

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|---|---|---|---|---|---|---|
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 |
| B/D | 3819 | 37875 | 0 | 0 | 0 | 0 |
| C | 9443 | 3612 | 0 | 0 | 0 | 0 |
| D | 19783 | 16409 | 0 | 0 | 0 | 0 |

**V. ONSITE AREAS - LOTS**

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|---|---|---|---|---|---|
| A | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 107 | 0 |
| D | 0 | 0 | 0 | 0 | 732 |

**VI. OFFSITE AREAS - ZONING**

| HSG | 90% impervious Right of Way | 30% impervious High Density Residential | 25% impervious Medium Density Residential | 20% impervious Low Density Residential | 85% impervious Commercial | 65% impervious Mixed Use Neighborhood | 85% impervious Business Park | 0% impervious Preserved Open Space | 85% impervious Town Center | 72% impervious School |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 77543 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 | 36707 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 45463 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 0 | 311989 | 0 | 0 | 0 | 0 |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 4 BYPASS*

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8/2/2021

**VII.  LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 0 | 0 | 0 | 0 |
| SingleFamily39 | 0 | 0 | 0 | 0 |
| SingleFamily40 | 0 | 0 | 0 | 0 |
| SingleFamily50 | 63 | 44 | 6 | 13 |
| SingleFamily60 | 366 | 256 | 37 | 73 |
| *Totals* | 429 | 300 | 43 | 86 |

**VIII. TOTAL DRAINAGE AREA RESULT**

| | | |
|---|---|---|
| Total Area per GIS Calc = | 12.94 | acres |
| | **563481** | sf |
| | | |
| Composite SCS CN = | 88 | |
| Total Impervious Area = | **307035** | sf |
| | | |
| % Impervious = | 54.5% | |

**IX.  TIME OF CONCENTRATION**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

*Segment 1: Overland Flow*

| | | |
|---|---|---|
| Length = | 100 | ft |
| Top Elev = | 389.00 | ft |
| Bot Elev = | 388.00 | ft |
| Height = | 1 | ft |
| Slope = | 0.0100 | ft/ft |
| Manning's n = | 0.17 | cultivated soils, residue cover |
| P (2-year/24-hour) = | 3.46 | inches (Rolesville, NC) |
| *Segment Time =* | *13.74* | *minutes* |

*Segment 2: Concentrated Flow*

| | | |
|---|---|---|
| Length = | 1855 | ft |
| Top Elev = | 388.00 | ft |
| Bot Elev = | 339.00 | ft |
| Height = | 49 | ft |
| Slope = | 0.0264 | ft/ft |
| Paved ? = | No | |
| Velocity = | 2.62 | ft/sec |
| *Segment Time =* | *11.79* | *minutes* |

*Segment 3: Channel Flow*

| | | |
|---|---|---|
| Length = | 2366 | ft |
| Top Elev = | 339.00 | ft |
| Bot Elev = | 302.00 | ft |
| Height = | 37 | ft |
| Slope = | 0.0156 | ft/ft |
| Manning's n = | 0.045 | natural channel |
| Flow Area = | 15.00 | sf (assume 5'w x 3'h channel) |
| Wetted Perimeter = | 11.00 | lf (assume 5'w x 3'h channel) |
| Channel Velocity = | 5.09 | ft/sec |
| *Segment Time =* | *7.74* | *minutes* |

| | | |
|---|---|---|
| **Time of Concentration =** | 33.28 | minutes |
| **SCS Lag Time =** | 19.97 | minutes (SCS Lag = 0.6* Tc) |
| **Time Increment =** | 5.79 | minutes (= 0.29*SCS Lag) |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 5 BYPASS*

T. DABOLT
8/2/2021

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

| HSG | Open | Wooded | Roads | Sidewalk | Pond | Crops |
|---|---|---|---|---|---|---|
| A | 39 | 30 | 98 | 98 | 100 | 67 |
| B | 61 | 55 | 98 | 98 | 100 | 78 |
| B/D | 80 | 77 | 98 | 98 | 100 | 89 |
| C | 74 | 70 | 98 | 98 | 100 | 85 |
| D | 80 | 77 | 98 | 98 | 100 | 89 |

BasinID: 11

**II. ONSITE SCS CURVE NUMBERS - LOTS**

| HSG | 22' Townhome | 39' Single Family | 40' Single Family | 50' Single Family | 60' Single Family |
|---|---|---|---|---|---|
| A | 93 | 77 | 76 | 74 | 69 |
| B | 95 | 85 | 84 | 83 | 80 |
| B/D | 96 | 92 | 91 | 91 | 89 |
| C | 96 | 90 | 89 | 88 | 86 |
| D | 96 | 92 | 91 | 91 | 89 |

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

| HSG | Right-Of-Way | Zoning - High Res (1/3 acre) | Zoning - Med Res (1/2 acre) | Zoning - Low Res (1 acre) | Zoning - Commercial | Zoning - MU Neighborhood | Zoning - Business Park | Zoning - Preserved Open | Town Center | School |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 83 | 57 | 54 | 51 | 89 | 72 | 89 | 39 | 89 | 75 |
| B | 89 | 72 | 70 | 68 | 92 | 85 | 92 | 61 | 92 | 88 |
| B/D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |
| C | 91 | 82 | 80 | 79 | 94 | 90 | 94 | 74 | 94 | 91 |
| D | 93 | 86 | 85 | 84 | 95 | 92 | 95 | 80 | 95 | 93 |

**IV. ONSITE AREAS - LAND COVER**

| HSG | Open | Onsite Wooded | Onsite Roads | Onsite Sidewalk | Pond | Onsite Crops |
|---|---|---|---|---|---|---|
| A | 19289 | 0 | 0 | 0 | 0 | 0 |
| B | 463037 | 165474 | 0 | 11246 | 0 | 3659 |
| B/D | 27508 | 6355 | 0 | 4062 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 588891 | 1286887 | 0 | 11685 | 0 | 0 |

**V. ONSITE AREAS - LOTS**

| HSG | Townhome22 | SingleFamily39 | SingleFamily40 | SingleFamily50 | SingleFamily60 |
|---|---|---|---|---|---|
| A | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 |
| B/D | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 |
| D | 96 | 0 | 0 | 0 | 0 |

**VI. OFFSITE AREAS - ZONING**

| HSG | 90% impervious Right of Way | 30% impervious High Density Residential | 25% impervious Medium Density Residential | 20% impervious Low Density Residential | 85% impervious Commercial | 65% impervious Mixed Use Neighborhood | 85% impervious Business Park | 0% impervious Preserved Open Space | 85% impervious Town Center | 72% impervious School |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 32917 | 0 | 310 | 0 | 0 | 0 | 272 | 17137 | 0 | 0 |
| B | 1041178 | 3084838 | 2087277 | 40019 | 0 | 294169 | 868 | 195327 | 284266 | 20637 |
| B/D | 68437 | 0 | 0 | 0 | 0 | 145164 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 1328907 | 2241086 | 1872118 | 80782 | 43820 | 531367 | 1360 | 1483036 | 75630 | 309591 |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Sub 5 BYPASS*

T. DABOLT
8/2/2021

**VII. LOT BREAKDOWN**

| Contributing Area | Total Impervious [sf] | Roof Area [sf] | Sidewalk Area [sf] | Driveway Area [sf] |
|---|---|---|---|---|
| Townhome22 | 87 | 61 | 9 | 17 |
| SingleFamily39 | 0 | 0 | 0 | 0 |
| SingleFamily40 | 0 | 0 | 0 | 0 |
| SingleFamily50 | 0 | 0 | 0 | 0 |
| SingleFamily60 | 0 | 0 | 0 | 0 |
| *Totals* | 87 | 61 | 9 | 17 |

**VIII. TOTAL DRAINAGE AREA RESULT**

| | | |
|---|---|---|
| Total Area per GIS Calc = | 410.21 | acres |
| | 17868706 | sf |
| | | |
| Composite SCS CN = | 80 | |
| Total Impervious Area = | 6077244 | sf |
| | | |
| % Impervious = | 34.0% | |

**IX. TIME OF CONCENTRATION**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

**Segment 1: Overland Flow**

| | | |
|---|---|---|
| Length = | 100 | ft |
| Top Elev = | 440.00 | ft |
| Bot Elev = | 438.00 | ft |
| Height = | 2 | ft |
| Slope = | 0.0200 | ft/ft |
| Manning's n = | 0.24 | dense grasses |
| P (2-year/24-hour) = | 3.46 | inches (Rolesville, NC) |
| *Segment Time =* | *13.72* | *minutes* |

**Segment 2: Concentrated Flow**

| | | |
|---|---|---|
| Length = | 2989 | ft |
| Top Elev = | 438.00 | ft |
| Bot Elev = | 372.00 | ft |
| Height = | 66 | ft |
| Slope = | 0.0221 | ft/ft |
| Paved ? = | No | |
| Velocity = | 2.40 | ft/sec |
| *Segment Time =* | *20.78* | *minutes* |

**Segment 3: Open Water Flow**

| | | |
|---|---|---|
| Length = | 655 | ft |
| Top Elev = | 372.00 | ft |
| Bot Elev = | 372.00 | ft |
| *Segment Time =* | *0.00* | *minutes* |

**Segment 4: Concentrated Flow**

| | | |
|---|---|---|
| Length = | 2379 | ft |
| Top Elev = | 372.00 | ft |
| Bot Elev = | 320.00 | ft |
| Height = | 52 | ft |
| Slope = | 0.0219 | ft/ft |
| Paved ? = | No | |
| Velocity = | 2.39 | ft/sec |
| *Segment Time =* | *16.62* | *minutes* |

**Segment 5: Channel Flow**

| | | |
|---|---|---|
| Length = | 3730 | ft |
| Top Elev = | 320.00 | ft |
| Bot Elev = | 292.00 | ft |
| Height = | 28 | ft |
| Slope = | 0.0075 | ft/ft |

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**POST-DEVELOPMENT HYDROLOGY**
*Subbasin Reach Data*

T. DABOLT
8/2/2021

**REACH DATA**

### Reach 1 - POA 1 to POA 4
| | | |
|---|---|---|
| Length = | 2988 | ft |
| Top Elev = | 344.00 | ft |
| Bot Elev = | 302.00 | ft |
| Height = | 42 | ft |
| Slope = | 0.0141 | ft/ft |
| Manning's n = | 0.045 | natural channel |
| Flow Area = | 10.00 | sf (assume 5'w x 2'h channel) |
| Wetted Perimeter = | 9.00 | lf (assume 5'w x 2'h channel) |
| Channel Velocity = | 4.21 | ft/sec |
| **Reach Travel Time =** | **11.83** | **minutes** |

### Reach 2 - SCM A to POA 1

| *Segment 1: Concentrated Flow* | | | | *Segment 2: Channel Flow* | | |
|---|---|---|---|---|---|---|
| Length = | 647 | ft | | Length = | 2038 | ft |
| Top Elev = | 377.00 | ft | | Top Elev = | 368.00 | ft |
| Bot Elev = | 368.00 | ft | | Bot Elev = | 344.00 | ft |
| Height = | 9 | ft | | Height = | 24 | ft |
| Slope = | 0.0139 | ft/ft | | Slope = | 0.0118 | ft/ft |
| Paved ? = | No | | | Manning's n = | 0.045 | natural channel |
| Velocity = | 1.90 | ft/sec | | Flow Area = | 12.00 | sf (assume 6'w x 2'h channel) |
| | | | | Wetted Perimeter = | 10.00 | lf (assume 6'w x 2'h channel) |
| | | | | Channel Velocity = | 4.06 | ft/sec |
| **Segment Time =** | **5.67** | **minutes** | | **Reach Travel Time =** | **8.37** | **minutes** |

**Total Reach Travel Time =** **14.04**

### Reach 3 - SCM C to POA 1

| *Segment 1: Concentrated Flow* | | | | *Segment 2: Channel Flow* | | |
|---|---|---|---|---|---|---|
| Length = | 83 | ft | | Length = | 1220 | ft |
| Top Elev = | 370.00 | ft | | Top Elev = | 366.00 | ft |
| Bot Elev = | 366.00 | ft | | Bot Elev = | 344.00 | ft |
| Height = | 4 | ft | | Height = | 22 | ft |
| Slope = | 0.0482 | ft/ft | | Slope = | 0.0180 | ft/ft |
| Paved ? = | No | | | Manning's n = | 0.045 | natural channel |
| Velocity = | 3.54 | ft/sec | | Flow Area = | 8.00 | sf (assume 4'w x 2'h channel) |
| | | | | Wetted Perimeter = | 8.00 | lf (assume 4'w x 2'h channel) |
| | | | | Channel Velocity = | 4.45 | ft/sec |
| **Segment Time =** | **0.39** | **minutes** | | **Reach Travel Time =** | **4.57** | **minutes** |

**Total Reach Travel Time =** **4.96**

### Reach 4 - SCM F to POA 4

| *Segment 1: Concentrated Flow* | | | | *Segment 2: Channel Flow* | | |
|---|---|---|---|---|---|---|
| Length = | 77 | ft | | Length = | 2292 | ft |
| Top Elev = | 339.00 | ft | | Top Elev = | 336.00 | ft |
| Bot Elev = | 336.00 | ft | | Bot Elev = | 302.00 | ft |
| Height = | 3 | ft | | Height = | 34 | ft |
| Slope = | 0.0390 | ft/ft | | Slope = | 0.0148 | ft/ft |
| Paved ? = | No | | | Manning's n = | 0.045 | natural channel |
| Velocity = | 3.18 | ft/sec | | Flow Area = | 10.00 | sf (assume 5'w x 2'h channel) |
| | | | | Wetted Perimeter = | 9.00 | lf (assume 5'w x 2'h channel) |
| | | | | Channel Velocity = | 4.33 | ft/sec |
| **Segment Time =** | **0.40** | **minutes** | | **Reach Travel Time =** | **8.83** | **minutes** |

**Total Reach Travel Time =** **9.23**

**POST-DEVELOPMENT HYDROLOGY**
*Subbasin GIS Output-Onsite*

**NUTRIENT INPUT SUMMARY**
*SCM A,B,C,D,E,F,G,H,I,J - Wet Pond*

| Land Use | Treated Area (sf) | Bypassed Area (sf) |
|---|---|---|
| Impervious | 3,099,079 | 80,366 |
| Pond | 165,231 | 301,794 |
| Open | 2,757,306 | 2,207,029 |
| Wooded | 74,326 | 3,023,652 |
| **Total** | **6,095,942** | **5,612,840** |

| | | |
|---|---|---|
| Total Lot Area = | 1905531 | sf |
| Total Treated Lot Area = | 1890177 | sf |
| Total Untreated Lot Area = | 15354 | sf |
| Total Lot Impervious = | 1054857 | sf |
| Total Lot Open = | 850674 | sf |

| | |
|---|---|
| SUB 1 TO SCM A | SUB 1 BYPASS |
| SUB 1 TO SCM C | SUB 2 BYPASS |
| SUB 1 TO SCM D | SUB 3 BYPASS |
| SUB 1 TO SCM E | SUB 4 BYPASS |
| SUB 4 TO SCM F | SUB 5 BYPASS |
| SUB 1 TO SCM B | |
| SUB 4 TO SCM G | |
| SUB 4 TO SCM H | |
| SUB 4 TO SCM I | |
| SUB 5 TO SCM J | |

| | |
|---|---|
| Total Area | 15659221 sf |
| Right of Way | 4531152 sf |
| Nitrogen Area | 11128069 sf |
| Treated+Untreated Total | 11708783 sf |

**TREATED AREA BREAKDOWN**

| | ONSITE ROADS | ONSITE SIDEWALK | RIGHT OF WAY | POND | ONSITE WOODED | ONSITE CROPS | OPEN | SINGLEFAMILY39 | SINGLEFAMILY40 | SINGLEFAMILY60 | SINGLEFAM50 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SCM A | 252621 | 76067 | 557 | 11367 | 0 | 4640 | 326989 | 0 | 91070 | 23114 | 0 |
| SCM C | 227589 | 69781 | 0 | 15117 | 0 | 892 | 174997 | 260004 | 181249 | 54142 | 0 |
| SCM D | 75024 | 26235 | 0 | 19613 | 0 | 0 | 74316 | 0 | 0 | 379717 | 0 |
| SCM E | 124125 | 50470 | 0 | 39596 | 0 | 8435 | 96523 | 107204 | 302418 | 165244 | 0 |
| SCM F | 253238 | 79872 | 0 | 16112 | 0 | 17271 | 235606 | 128071 | 171872 | 26072 | 0 |
| SCM B | 126217 | 46696 | 6211 | 8653 | 0 | 0 | 260572 | 0 | 0 | 0 | 0 |
| SCM G | 152537 | 50224 | 0 | 15833 | 0 | 0 | 155473 | 0 | 0 | 0 | 129109 |
| SCM H | 200143 | 58605 | 0 | 17405 | 9457 | 0 | 98256 | 0 | 0 | 0 | 460046 |
| SCM I | 48791 | 17124 | 0 | 7845 | 0 | 0 | 122379 | 0 | 0 | 0 | 225479 |
| SCM J | 85552 | 31810 | 0 | 13690 | 64869 | 0 | 337136 | 0 | 0 | 0 | 232595 |

**BYPASSED AREA BREAKDOWN**

| | ONSITE ROADS | ONSITE SIDEWALK | RIGHT OF WAY | POND | ONSITE WOODED | ONSITE CROPS | OPEN | ONSITE TRAIL | SINGLEFAMILY39 | SINGLEFAMILY40 | SINGLEFAMILY60 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SUB 1 BYPASS | 15367 | 47112 | 1028781 | 301794 | 543791 | 229656 | 1760613 | 0 | 0 | 0 | 15337 |
| SUB 2 BYPASS | 0 | 9387 | 1125518 | 0 | 191748 | 27289 | 139629 | 0 | 17 | 0 | 0 |
| SUB 3 BYPASS | 0 | 0 | 0 | 0 | 190485 | 0 | 42988 | 0 | 0 | 0 | 0 |
| SUB 4 BYPASS | 0 | 5 | 0 | 0 | 510334 | 0 | 260349 | 0 | 0 | 0 | 732 |
| SUB 5 BYPASS | 0 | 38238 | 2370086 | 0 | 1587294 | 3660 | 2772066 | 0 | 0 | 0 | 0 |

THE POINTE
AWH20000

**POST-DEVELOPMENT HYDROLOGY**

*Subbasin Lot Assumptions*

T. DABOLT
8/2/2021

**Lot Impervious Assumptions**

|  | Max. Imp. Assumption | Avg Lot Dimensions | Avg Lot Area | % Impervious |
|---|---|---|---|---|
| 22' Townhome | 1500 | 22 x 75 | 1650 | 91% |
| 39' Single Family | 2900 | 39 x 115 | 4485 | 65% |
| 40' Single Family | 3100 | 40 x 125 | 5000 | 62% |
| 50' Single Family | 3600 | 50 x 123 | 6150 | 59% |
| 60' Single Family | 4200 | 60 x 140 | 8400 | 50% |

**Curve Number Assumptions (Composite)**

|  | HSG A | HSG B | HSG C | HSG D |
|---|---|---|---|---|
| 22' Townhome | 93 | 95 | 96 | 96 |
| 39' Single Family | 77 | 85 | 90 | 92 |
| 40' Single Family | 76 | 84 | 89 | 91 |
| 50' Single Family | 74 | 83 | 88 | 91 |
| 60' Single Family | 69 | 80 | 86 | 89 |

**Lot Breakdown Assumptions**

|  | Roof | Sidewalk | Driveway |
|---|---|---|---|
| 22' Townhome | 70% | 10% | 20% |
| 39' Single Family | 70% | 10% | 20% |
| 40' Single Family | 70% | 10% | 20% |
| 50' Single Family | 70% | 10% | 20% |
| 60' Single Family | 70% | 10% | 20% |

AWH20000-CDPackage2.ppc
8/2/2021

27 Siemon Company Drive Suite 200 W  Watertown, CT
06795 USA  +1-203-755-1666

T. Dabolt
McAdams
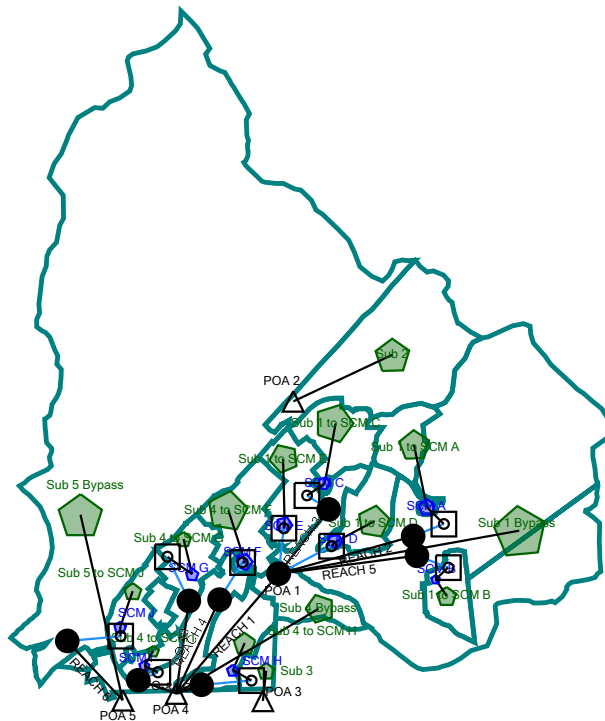
# FlexTable: Catchment Table (AWH20000-CDPackage2.ppc)

## Current Time:  0.00 min

| Label | Outflow Node | Area (ft²) | SCS CN | Time of Concentration (min) | Notes |
|---|---|---|---|---|---|
| Sub 2 | POA 2 | 2,377,665 | 87 | 31.12 | POST |
| Sub 1 Bypass | POA 1 | 8,566,708 | 87 | 40.80 | POST |
| Sub 1 to SCM A | SCM A | 541,712 | 85 | 5.00 | POST |
| Sub 1 to SCM D | SCM D | 575,524 | 81 | 5.00 | POST |
| Sub 1 to SCM C | SCM C | 683,134 | 86 | 5.00 | POST |
| Sub 1 to SCM E | SCM E | 749,339 | 87 | 5.00 | POST |
| Sub 4 to SCM F | SCM F | 1,004,058 | 89 | 5.00 | POST |
| Sub 4 Bypass | POA 4 | 3,364,834 | 79 | 33.28 | POST |
| Sub 4 to SCM G | SCM G | 595,094 | 90 | 5.00 | POST |
| Sub 4 to SCM H | SCM H | 714,538 | 89 | 5.00 | POST |
| Sub 5 to SCM J | SCM J | 618,061 | 85 | 5.00 | POST |
| Sub 4 to SCM I | SCM I | 364,606 | 87 | 5.00 | POST |
| Sub 1 to SCM B | SCM B | 447,048 | 87 | 5.00 | POST |
| Sub 3 | POA 3 | 234,442 | 77 | 15.64 | POST |
| Sub 5 Bypass | POA 5 | 17,868,706 | 80 | 48.15 | POST |

AWH20000-CDPackage2.ppc
8/2/2021

27 Siemon Company Drive Suite 200 W  Watertown, CT
06795 USA  +1-203-755-1666

T. Dabolt
McAdams

## Catchments Summary

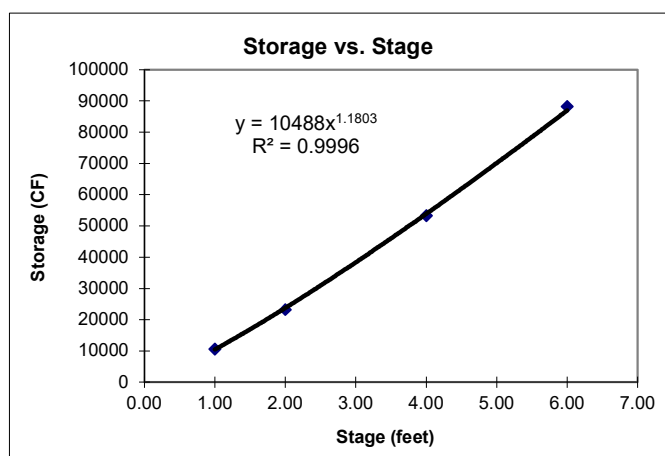| Label | Scenario | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (min) | Peak Flow (ft³/s) |
|---|---|---|---|---|---|
| Sub 2 | Post-Dev 1 yr | 1 | 7.297 | 739.00 | 70.4 |
| Sub 2 | Post-Dev 10 yr | 10 | 16.357 | 738.00 | 139.4 |
| Sub 2 | Post-Dev 25 yr | 25 | 20.492 | 738.00 | 165.4 |
| Sub 2 | Post-Dev 100 yr | 100 | 27.422 | 738.00 | 204.4 |
| Sub 1 Bypass | Post-Dev 1 yr | 1 | 26.222 | 745.00 | 214.1 |
| Sub 1 Bypass | Post-Dev 10 yr | 10 | 58.798 | 745.00 | 431.6 |
| Sub 1 Bypass | Post-Dev 25 yr | 25 | 73.674 | 745.00 | 515.6 |
| Sub 1 Bypass | Post-Dev 100 yr | 100 | 98.640 | 745.00 | 644.7 |
| Sub 1 to SCM A | Post-Dev 1 yr | 1 | 1.523 | 721.00 | 32.8 |
| Sub 1 to SCM A | Post-Dev 10 yr | 10 | 3.543 | 721.00 | 64.3 |
| Sub 1 to SCM A | Post-Dev 25 yr | 25 | 4.473 | 721.00 | 75.3 |
| Sub 1 to SCM A | Post-Dev 100 yr | 100 | 6.034 | 721.00 | 91.2 |
| Sub 1 to SCM D | Post-Dev 1 yr | 1 | 1.327 | 722.00 | 28.0 |
| Sub 1 to SCM D | Post-Dev 10 yr | 10 | 3.341 | 721.00 | 61.0 |
| Sub 1 to SCM D | Post-Dev 25 yr | 25 | 4.291 | 721.00 | 73.0 |
| Sub 1 to SCM D | Post-Dev 100 yr | 100 | 5.902 | 721.00 | 90.5 |
| Sub 1 to SCM C | Post-Dev 1 yr | 1 | 2.014 | 721.00 | 43.5 |
| Sub 1 to SCM C | Post-Dev 10 yr | 10 | 4.598 | 721.00 | 83.2 |
| Sub 1 to SCM C | Post-Dev 25 yr | 25 | 5.781 | 721.00 | 97.0 |
| Sub 1 to SCM C | Post-Dev 100 yr | 100 | 7.762 | 721.00 | 116.8 |
| Sub 1 to SCM E | Post-Dev 1 yr | 1 | 2.316 | 721.00 | 50.1 |
| Sub 1 to SCM E | Post-Dev 10 yr | 10 | 5.189 | 721.00 | 93.5 |
| Sub 1 to SCM E | Post-Dev 25 yr | 25 | 6.496 | 721.00 | 108.5 |
| Sub 1 to SCM E | Post-Dev 100 yr | 100 | 8.681 | 721.00 | 130.0 |
| Sub 4 to SCM F | Post-Dev 1 yr | 1 | 3.403 | 721.00 | 73.6 |
| Sub 4 to SCM F | Post-Dev 10 yr | 10 | 7.347 | 721.00 | 131.2 |
| Sub 4 to SCM F | Post-Dev 25 yr | 25 | 9.123 | 721.00 | 150.7 |
| Sub 4 to SCM F | Post-Dev 100 yr | 100 | 12.081 | 721.00 | 178.7 |
| Sub 4 Bypass | Post-Dev 1 yr | 1 | 6.923 | 741.00 | 61.4 |
| Sub 4 Bypass | Post-Dev 10 yr | 10 | 18.194 | 741.00 | 150.8 |
| Sub 4 Bypass | Post-Dev 25 yr | 25 | 23.601 | 741.00 | 187.1 |
| Sub 4 Bypass | Post-Dev 100 yr | 100 | 32.855 | 741.00 | 243.0 |
| Sub 4 to SCM G | Post-Dev 1 yr | 1 | 2.111 | 721.00 | 45.5 |
| Sub 4 to SCM G | Post-Dev 10 yr | 10 | 4.474 | 721.00 | 79.4 |
| Sub 4 to SCM G | Post-Dev 25 yr | 25 | 5.533 | 721.00 | 90.8 |
| Sub 4 to SCM G | Post-Dev 100 yr | 100 | 7.294 | 721.00 | 107.2 |
| Sub 4 to SCM H | Post-Dev 1 yr | 1 | 2.422 | 721.00 | 52.3 |
| Sub 4 to SCM H | Post-Dev 10 yr | 10 | 5.228 | 721.00 | 93.4 |
| Sub 4 to SCM H | Post-Dev 25 yr | 25 | 6.492 | 721.00 | 107.2 |
| Sub 4 to SCM H | Post-Dev 100 yr | 100 | 8.597 | 721.00 | 127.2 |
| Sub 5 to SCM J | Post-Dev 1 yr | 1 | 1.737 | 721.00 | 37.4 |
| Sub 5 to SCM J | Post-Dev 10 yr | 10 | 4.043 | 721.00 | 73.4 |
| Sub 5 to SCM J | Post-Dev 25 yr | 25 | 5.104 | 721.00 | 85.9 |
| Sub 5 to SCM J | Post-Dev 100 yr | 100 | 6.885 | 721.00 | 104.1 |
| Sub 4 to SCM I | Post-Dev 1 yr | 1 | 1.127 | 721.00 | 24.4 |
| Sub 4 to SCM I | Post-Dev 10 yr | 10 | 2.525 | 721.00 | 45.5 |
| Sub 4 to SCM I | Post-Dev 25 yr | 25 | 3.161 | 721.00 | 52.8 |
| Sub 4 to SCM I | Post-Dev 100 yr | 100 | 4.224 | 721.00 | 63.2 |
| Sub 1 to SCM B | Post-Dev 1 yr | 1 | 1.382 | 721.00 | 29.9 |
| Sub 1 to SCM B | Post-Dev 10 yr | 10 | 3.095 | 721.00 | 55.8 |
| Sub 1 to SCM B | Post-Dev 25 yr | 25 | 3.875 | 721.00 | 64.7 |
| Sub 1 to SCM B | Post-Dev 100 yr | 100 | 5.179 | 721.00 | 77.5 |
| Sub 3 | Post-Dev 1 yr | 1 | 0.435 | 730.00 | 5.8 |
| Sub 3 | Post-Dev 10 yr | 10 | 1.193 | 728.00 | 14.6 |
| Sub 3 | Post-Dev 25 yr | 25 | 1.562 | 728.00 | 18.0 |
| Sub 3 | Post-Dev 100 yr | 100 | 2.195 | 728.00 | 23.1 |

**Pond Summary**

| Label | Scenario | Return Event (years) | Hydrograph Volume (ac-ft) | Time to Peak (min) | Peak Flow (ft³/s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ac-ft) |
|---|---|---|---|---|---|---|---|
| SCM J (IN) | Post-Dev 1 yr | 1 | 1.737 | 721.00 | 37.4 | (N/A) | (N/A) |
| SCM J (OUT) | Post-Dev 1 yr | 1 | 0.615 | 900.00 | 1.2 | 313.11 | 1.160 |
| SCM J (IN) | Post-Dev 10 yr | 10 | 4.043 | 721.00 | 73.4 | (N/A) | (N/A) |
| SCM J (OUT) | Post-Dev 10 yr | 10 | 2.897 | 731.00 | 23.0 | 314.35 | 1.755 |
| SCM J (IN) | Post-Dev 25 yr | 25 | 5.104 | 721.00 | 85.9 | (N/A) | (N/A) |
| SCM J (OUT) | Post-Dev 25 yr | 25 | 3.952 | 727.00 | 48.2 | 314.72 | 1.943 |
| SCM J (IN) | Post-Dev 100 yr | 100 | 6.885 | 721.00 | 104.1 | (N/A) | (N/A) |
| SCM J (OUT) | Post-Dev 100 yr | 100 | 5.732 | 725.00 | 74.0 | 315.10 | 2.147 |
| SCM I (IN) | Post-Dev 1 yr | 1 | 1.127 | 721.00 | 24.4 | (N/A) | (N/A) |
| SCM I (OUT) | Post-Dev 1 yr | 1 | 0.154 | 1,440.00 | 0.2 | 321.88 | 0.972 |
| SCM I (IN) | Post-Dev 10 yr | 10 | 2.525 | 721.00 | 45.5 | (N/A) | (N/A) |
| SCM I (OUT) | Post-Dev 10 yr | 10 | 1.512 | 730.00 | 15.5 | 322.43 | 1.142 |
| SCM I (IN) | Post-Dev 25 yr | 25 | 3.161 | 721.00 | 52.8 | (N/A) | (N/A) |
| SCM I (OUT) | Post-Dev 25 yr | 25 | 2.148 | 727.00 | 28.9 | 322.81 | 1.262 |
| SCM I (IN) | Post-Dev 100 yr | 100 | 4.224 | 721.00 | 63.2 | (N/A) | (N/A) |
| SCM I (OUT) | Post-Dev 100 yr | 100 | 3.211 | 725.00 | 46.1 | 323.22 | 1.392 |
| SCM G (IN) | Post-Dev 1 yr | 1 | 2.111 | 721.00 | 45.5 | (N/A) | (N/A) |
| SCM G (OUT) | Post-Dev 1 yr | 1 | 0.378 | 1,440.00 | 0.4 | 343.67 | 1.733 |
| SCM G (IN) | Post-Dev 10 yr | 10 | 4.474 | 721.00 | 79.4 | (N/A) | (N/A) |
| SCM G (OUT) | Post-Dev 10 yr | 10 | 2.660 | 733.00 | 20.3 | 344.42 | 2.170 |
| SCM G (IN) | Post-Dev 25 yr | 25 | 5.533 | 721.00 | 90.8 | (N/A) | (N/A) |
| SCM G (OUT) | Post-Dev 25 yr | 25 | 3.716 | 728.00 | 40.9 | 344.83 | 2.418 |
| SCM G (IN) | Post-Dev 100 yr | 100 | 7.294 | 721.00 | 107.2 | (N/A) | (N/A) |
| SCM G (OUT) | Post-Dev 100 yr | 100 | 5.476 | 727.00 | 62.7 | 345.33 | 2.727 |

*STORMWATER CONTROL MEASURE 'B'*
*DESIGN CALCULATIONS*

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'B'**

*SSFxn Above NP*

T. DABOLT
8/2/2021

STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 376.00 | 0.00 | 9,314 | | | | |
| 377.00 | 1.00 | 11,965 | 10640 | 10640 | 10640 | 1.01 |
| 378.00 | 2.00 | 13,375 | 12670 | 12670 | 23310 | 1.97 |
| 380.00 | 4.00 | 16,627 | 15001 | 30002 | 53312 | 3.97 |
| 382.00 | 6.00 | 18,355 | 17491 | 34982 | 88294 | 6.08 |

**Storage vs. Stage**

$y = 10488x^{1.1803}$
$R^2 = 0.9996$

Storage (CF) vs. Stage (feet)

| | |
|---|---|
| $K_S =$ | 10488 |
| $b =$ | 1.1803 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'B'**

*SSFxn Main Pool*

T. DABOLT
8/2/2021

STAGE-STORAGE FUNCTION - MAIN POOL

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 368.50 | -0.50 | 2,669 | Sediment Storage | | | |
| 369.00 | 0.00 | 2,909 | | | | |
| 373.00 | 4.00 | 5,055 | 3982 | 15928 | 15928 | 4.01 |
| 374.00 | 5.00 | 5,654 | 5355 | 5355 | 21283 | 4.98 |
| 375.00 | 6.00 | 6,278 | 5966 | 5966 | 27249 | 5.98 |
| 376.00 | 7.00 | 6,928 | 6603 | 6603 | 33852 | 7.03 |

*surface area and volume used for avg. depth calculation
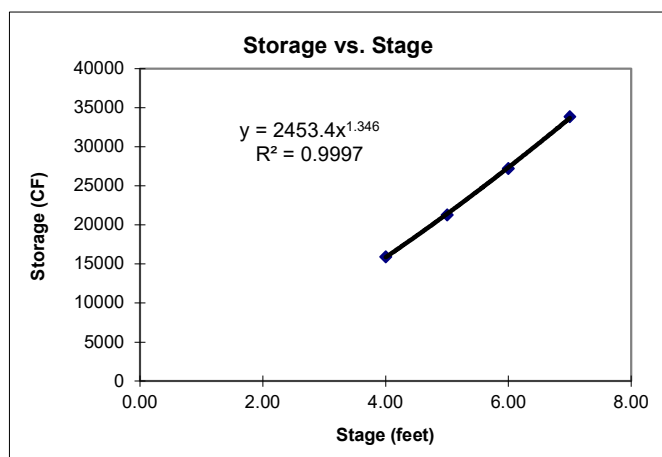
**Storage vs. Stage**

$y = 2453.4x^{1.346}$
$R^2 = 0.9997$

| | |
|---|---|
| $K_S =$ | 2453 |
| $b =$ | 1.3460 |

**STORMWATER CONTROL MEASURE 'B'**

*SSFxn Forebay*

STAGE-STORAGE FUNCTION - FOREBAY

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 369.50 | -0.50 | 120 | | Sediment Storage | | |
| 370.00 | 0.00 | 199 | | | | |
| 374.00 | 4.00 | 1,054 | 627 | 2506 | 2506 | 4.01 |
| 375.00 | 5.00 | 1,330 | 1192 | 1192 | 3698 | 4.98 |
| 376.00 | 6.00 | 1,632 | 1481 | 1481 | 5179 | 6.01 |

**Storage vs. Stage**

$y = 209.3x^{1.7886}$
$R^2 = 0.9997$



| | |
|---|---|
| $K_S =$ | 209.3 |
| $b =$ | 1.7886 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'B'**
*Volume Calculation*

T. DABOLT
8/2/2021
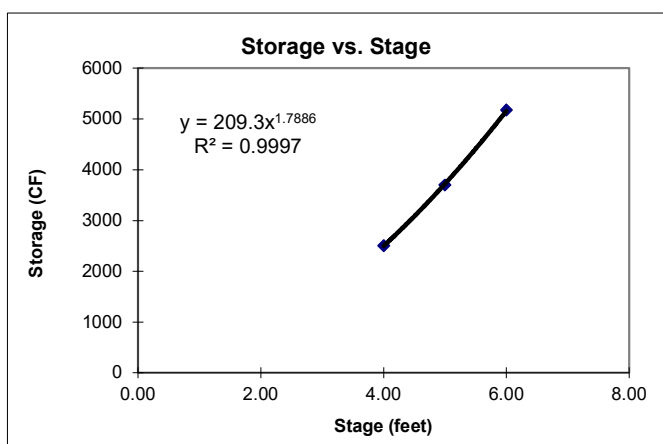
| TOTAL VOLUME OF FACILITY | | |
|---|---|---|
| Volume of Main Pool below Normal Pool= | 33,852 | cf |
| Volume of Forebay below Normal Pool= | 5,179 | cf |
| Total Volume Below Normal Pool = | 39,031 | cf |
| Total Volume Above Normal Pool= | 88,294 | cf |
| Total Volume of Facility = | 127,324 | cf |

**FOREBAY PERCENTAGE OF PERMANENT POOL VOLUME**

*Per NCDEQ Minimum Design Criteria, the forebay volume should equal approximately 15-20% of the main pool volume.*

| | | |
|---|---|---|
| Total Main Pool Volume = | 33,852 | cf |
| Provided Forebay Volume = | 5,179 | cf |
| Provided Forebay Volume % = | 15% | |

**AVERAGE DEPTH OF MAIN POOL**

| | | |
|---|---|---|
| Main Pool Volume at Normal Pool = | 33,852 | cf |
| Main Pool Area at Normal Pool = | 6,928 | sf |
| Average Depth = | 4.89 | ft |

**STORMWATER CONTROL MEASURE 'B'**

*Surface Area Calculation*

WET DETENTION BASIN SUMMARY

*Enter the drainage area characteristics ==>*

| | | |
|---|---|---|
| Total drainage area to pond = | 10.26 | acres |
| Total impervious area to pond = | 6.11 | acres |

<u>Note</u>  *The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.*

Drainage area = **10.26** acres @ **59.6%** impervious

*Estimate the surface area required at pond normal pool elevation ==>*

Wet Detention Basins are based on an minimum average depth of  =  **4.89**  feet

| | | 4.0 | 4.89 | 5.0 |
|---|---|---|---|---|
| Lower Boundary => | 50.0 | 1.51 | | 1.31 |
| Site % impervious => | 59.6 | 1.76 | *1.51* | 1.48 |
| Upper Boundary => | 60.0 | 1.77 | | 1.49 |

| Therefore, SA/DA required = | *1.51* |
|---|---|

| | | | |
|---|---|---|---|
| Surface area required for main pool at normal pool = | 6,766 | ft$^2$ | 9134 |
| = | 0.16 | acres | |
| Surface area provided for total normal pool = | 9,314 | ft$^2$ | |
| Surface area provided for main pool at normal pool = | 6,928 | ft$^2$ | |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'B'**

*WQV Calculation*

T. DABOLT
8/2/2021

DETERMINATION OF WATER QUALITY VOLUME

$WQ_V = (P)(R_V)(A)/12$

where,

$WQ_V$ = water quality volume (in acre-ft)
$R_V$ = 0.05+0.009(I) where I is percent impervious cover
A = area in acres
P = rainfall (in inches)

*Input data:*

| | | |
|---|---|---|
| Total area, A = | 10.26 | acres |
| Impervious area = | 6.11 | acres |
| Percent impervious cover, I = | 59.6 | % |
| Rainfall, P = | 1.00 | inches |

*Calculated values:*

| | | |
|---|---|---|
| $R_V$ = | 0.59 | |
| $WQ_V$ = | 0.50 | acre-ft |
| = | 21829 | cf. |

ASSOCIATED DEPTH IN POND

| | | |
|---|---|---|
| $WQ_V$ = | 21829 | cf. |

*Stage / Storage Data:*

| | | |
|---|---|---|
| Ks = | 10488 | |
| b = | 1.180 | |
| Zo = | 376.00 | |
| Volume in 1" rainfall = | 21829 | cf. |

*Calculated values:*

| | | |
|---|---|---|
| Depth of WQv in Basin = | 1.86 | ft |
| = | 22.33 | inches |
| Elevation = | 377.86 | ft |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'B'**
*WQV Drawdown Calculation*

T. DABOLT
8/2/2021

DRAWDOWN ORIFICE DESIGN

| | | |
|---|---:|---|
| D orifice = | 2 | inch |
| # orifices = | 1 | |
| Ks = | 10488 | |
| b = | 1.1803 | |
| $C_d$ orifice = | 0.60 | |
| Normal Pool Elevation = | 376.00 | feet |
| Volume @ Normal Pool = | 0 | cf |
| Orifice Invert = | 376.00 | feet |
| WSEL @ 1" Runoff Volume = | 377.86 | feet |

| WSEL (feet) | Vol. Stored (cf) | Orifice Flow (cfs) | Avg. Flow (cfs) | Incr. Vol. (cf) | Incr. Time (sec) |
|---|---|---|---|---|---|
| 377.86 | 21829 | 0.140 | | | |
| 377.70 | 19637 | 0.133 | 0.137 | 2193 | 16051 |
| 377.54 | 17481 | 0.127 | 0.130 | 2156 | 16581 |
| 377.38 | 15365 | 0.120 | 0.123 | 2116 | 17191 |
| 377.22 | 13292 | 0.112 | 0.116 | 2072 | 17907 |
| 377.06 | 11269 | 0.104 | 0.108 | 2024 | 18764 |
| 376.90 | 9299 | 0.095 | 0.099 | 1970 | 19821 |
| 376.74 | 7391 | 0.085 | 0.090 | 1908 | 21176 |
| 376.58 | 5557 | 0.074 | 0.080 | 1835 | 23018 |
| 376.42 | 3811 | 0.061 | 0.068 | 1745 | 25776 |
| 376.26 | 2183 | 0.045 | 0.053 | 1628 | 30760 |

| Drawdown Time = | 2.40 days |
|---|---|

By comparison, if calculated by the average head over the orifice
(assuming average head is one-third the total depth), the result would be:

| | | |
|---|---:|---|
| Average driving head on orifice = | 0.593 | feet |
| Orifice composite loss coefficient = | 0.600 | |
| Cross-sectional area of siphon = | 0.022 | sf |
| Q = | 0.0809 | cfs |

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

| Drawdown Time = | 3.12 days |
|---|---|

THE POINTE
AWH20000

**STORMWATER CONTROL MEASURE 'B'**
*Anti-Flotation Block Calculations*

T. DABOLT
8/2/2021

### RISER ANTI-FLOTATION CALCULATION

**Input Data ==>**

*Safety Factor:*

| | | |
|---|---|---|
| Safety factor to use = | 1.15 | (recommend 1.15 or higher) |

*Concrete:*

| | | | |
|---|---|---|---|
| Concrete unit weight = | 142.0 | PCF | **Note:** NC Products lists unit wt. of manhole concrete at 142 PCF. |

*Riser:*

| | | |
|---|---|---|
| Inside height of Riser = | 5.00 | feet |
| Inside length of riser = | 4.00 | feet |
| Inside width of riser = | 4.00 | feet |
| Wall thickness of riser = | 6.00 | inches |
| Base thickness of riser = | 6.00 | inches |
| Base length of riser = | 5.00 | feet |
| Base width of riser = | 5.00 | feet |

*Openings:*

| | | |
|---|---|---|
| Total Orifice Area = | 4.587 | SF |
| OD of barrel exiting manhole = | 30.00 | inches |
| Size of drain pipe (if present) = | 6.0 | inches |

*Trash Rack:*

| | | |
|---|---|---|
| Bottom Length = | 7.00 | feet |
| Bottom Width = | 7.00 | feet |
| Top Length = | 1.00 | feet |
| Top Width = | 1.00 | feet |
| Height = | 2.00 | feet |
| Trash Rack water displacement = | 38.00 | CF |

**Concrete Present in Riser Structure ==>**

*Total amount of concrete:*

| | | |
|---|---|---|
| Base of Riser = | 12.50 | CF |
| Riser Walls = | 45.00 | CF |

*Adjust for openings:*

| | | |
|---|---|---|
| Opening for Orifices = | 2.29 | CF |
| Opening for barrel = | 2.45 | CF |
| Opening for drain pipe = | 0.10 | CF |

| | | |
|---|---|---|
| Total Concrete present, adjusted for openings = | *52.654* | *CF* |
| Weight of concrete present = | *7,477* | *lbs* |

THE POINTE
AWH20000

**STORMWATER CONTROL MEASURE 'B'**

*Anti-Flotation Block Calculations*

T. DABOLT

8/2/2021

*Amount of water displaced by Riser Structure ==>*

| | | |
|---|---|---|
| Displacement by concrete = | 52.65 | CF |
| Displacement by open air in riser = | 80.00 | CF |
| Displacement by trash rack = | 38.00 | CF |
| Total water displaced by riser/barrel structure = | **170.65** | **CF** |
| Weight of water displaced = | **10,649** | **lbs** |

*Calculate size of base for riser assembly ==>*

| | | |
|---|---|---|
| Length = | 8.00 | feet |
| Width = | 8.00 | feet |
| Thickness = | 12 | inches |
| Concrete Present = | 64.00 | CF |

*Check validity of base as designed ==>*

| | | |
|---|---|---|
| Total Water Displaced = | 222.15 | CF |
| Total Concrete Present = | 116.65 | CF |
| Total Water Displaced = | 13,862 | lbs |
| Total Concrete Present = | 16,565 | lbs |
| *Actual safety factor =* | *1.19* | **OK** |

*Results of design ==>*

| | | |
|---|---|---|
| **Base length =** | **8.00** | **feet** |
| **Base width =** | **8.00** | **feet** |
| **Base Thickness =** | **12.00** | **inches** |
| **CY of concrete total in base =** | **2.37** | **CY** |
| **Concrete unit weight in added base >=** | **142.0** | **PCF** |

THE POINTE
AWH20000

**STORMWATER CONTROL MEASURE 'B'**
*Anti-Flotation Block Calculations*

T. DABOLT
8/2/2021

## II. CALCULATION FOR RISER ANTI-FLOTATION STEEL

**Input Data ==>**

|  |  |  |
|---|---|---|
| Anti-Floatation Block Length = | 8.0 | feet |
| Anti-Floatation Block Width = | 8.0 | feet |
| Anti-Floatation Block Thickness = | 12 | inches |
| $A_{steel}$ to $A_{concrete}$ Ratio = | 0.0020 | (recommend 0.0018 or hi |

**Cross-Section Calculations==>**

|  |  |  |
|---|---|---|
| Cross-Section Area* = | 8.00 | SF |
| Minimum Steel Area Required = | 0.016 | SF |
|  | **2.30** | SI |

*Note: Assumes a "square" x-sec (L and W same)*

**Rebar Calculations ==>**

| Bar Size | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|
| Diameter (inches) | 0.500 | 0.625 | 0.750 | 0.875 | 1.000 |
| X-Sec Area (SI) | 0.196 | 0.307 | 0.442 | 0.601 | 0.785 |
| Minimum Number of Bars | 12 | 8 | 6 | 4 | 3 |

# DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

| | | | | |
|---|---|---|---|---|
| Project | The Point | | Date | 8/2/2021 |
| Project No. | AWH-20000 | | Designer | TKD |
| Outlet ID | SCM B | | | |

| | | |
|---|---|---|
| Flow, $Q_{10-yr}$ | 22.5 | cfs |
| Slope, S | 2.00 | % |
| Pipe Diameter, $D_o$ | 24 | inches |
| Pipe Diameter, $D_o$ | 2.0 | feet |
| Number of pipes | 1 | |
| Pipe separation | 0 | feet |
| Manning's n | 0.013 | |

**Figure 8.06.b.1**



Velocity (ft/sec) vs Pipe diameter (ft). Zones 1–7 shown. Point at 11.1 ft/sec.
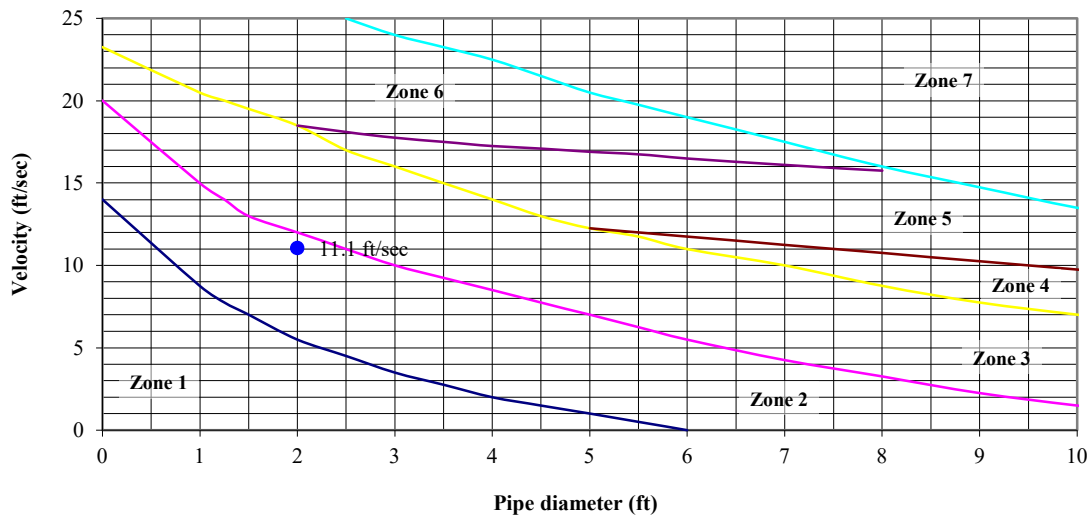
Zone from graph above = 3

| | | | |
|---|---|---|---|
| Outlet pipe diameter | 24 in. | Length = | 16.0 ft. |
| Outlet flowrate | 22.5 cfs | Width = | 6.0 ft. |
| Outlet velocity | 11.1 ft/sec | Stone diameter = | 13 in. |
| Material = | Class I | Thickness = | 22 in. |

| Zone | Material | Diameter | Thickness | Length | Width |
|---|---|---|---|---|---|
| 1 | Class A | 3 | 9 | 4 x D(o) | 3 x D(o) |
| 2 | Class B | 6 | 22 | 6 x D(o) | 3 x D(o) |
| 3 | Class I | 13 | 22 | 8 x D(o) | 3 x D(o) |
| 4 | Class I | 13 | 22 | 8 x D(o) | 3 x D(o) |
| 5 | Class II | 23 | 27 | 10 x D(o) | 3 x D(o) |
| 6 | Class II | 23 | 27 | 10 x D(o) | 3 x D(o) |
| 7 | Special study required | | | | |

1. Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual
2. Outlet velocity based on full-flow velocity

# STORMWATER CONTROL MEASURE 'G'
# DESIGN CALCULATIONS

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'G'**

*SSFxn Above NP*

T. DABOLT

8/2/2021

STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 340.00 | 0.00 | 15,673 | | | | |
| 341.00 | 1.00 | 19,251 | 17462 | 17462 | 17462 | 1.01 |
| 342.00 | 2.00 | 21,125 | 20188 | 20188 | 37650 | 1.97 |
| 344.00 | 4.00 | 25,043 | 23084 | 46168 | 83818 | 3.95 |
| 346.00 | 6.00 | 29,187 | 27115 | 54230 | 138048 | 6.09 |
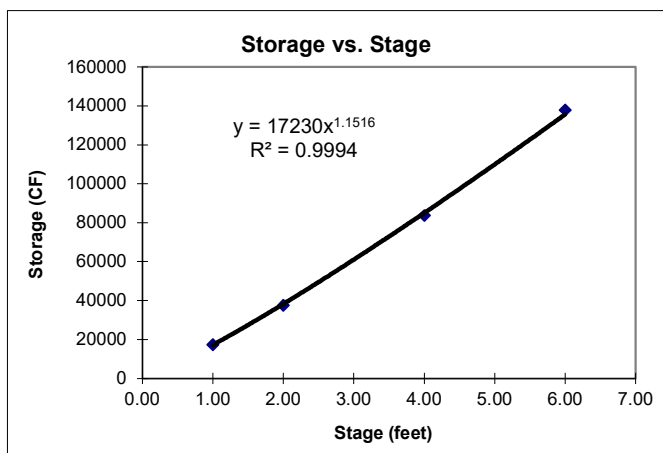
**Storage vs. Stage**

$y = 17230x^{1.1516}$
$R^2 = 0.9994$

| | |
|---|---|
| $K_S =$ | 17230 |
| $b =$ | 1.1516 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'G'**

*SSFxn Main Pool*

T. DABOLT
8/2/2021

STAGE-STORAGE FUNCTION - MAIN POOL

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 335.00 | -1.00 | 8,242 | Sediment Storage | | | |
| 336.00 | 0.00 | 9,028 | | | | |
| 337.00 | 1.00 | 9,838 | 9433 | 9433 | 9433 | 1.01 |
| 338.00 | 2.00 | 10,674 | 10256 | 10256 | 19689 | 1.98 |
| 339.00 | 3.00 | 11,535 | 11105 | 11105 | 30794 | 2.98 |
| 340.00 | 4.00 | 12,421 | 11978 | 11978 | 42772 | 4.04 |

*surface area and volume used for avg. depth calculation*
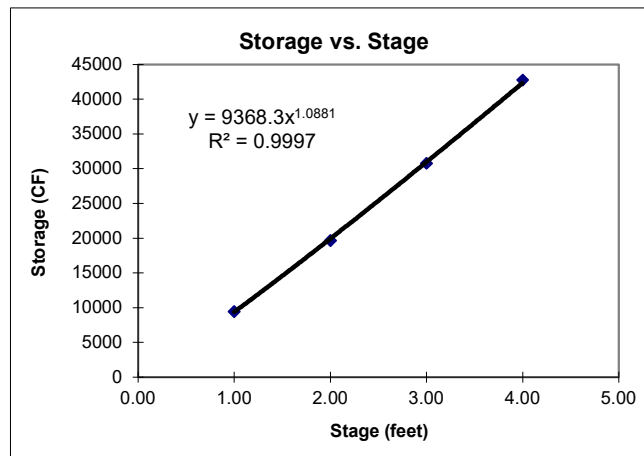


**Storage vs. Stage**

$y = 9368.3x^{1.0881}$
$R^2 = 0.9997$

| | |
|---|---|
| $K_S =$ | 9368 |
| $b =$ | 1.0881 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'G'**
*SSFxn Forebay*

T. DABOLT
8/2/2021

STAGE-STORAGE FUNCTION - FOREBAY

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 336.00 | -1.00 | 1,259 | | Sediment Storage | | |
| 337.00 | 0.00 | 1,574 | | | | |
| 338.00 | 1.00 | 1,915 | 1745 | 1745 | 1745 | 1.00 |
| 339.00 | 2.00 | 2,280 | 2098 | 2098 | 3842 | 1.98 |
| 340.00 | 3.00 | 2,671 | 2476 | 2476 | 6318 | 3.02 |

**Storage vs. Stage**

$y = 1735.1x^{1.1679}$
$R^2 = 0.9995$

| | |
|---|---|
| $K_S =$ | 1735.1 |
| $b =$ | 1.1679 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'G'**

*Volume Calculation*

T. DABOLT
8/2/2021
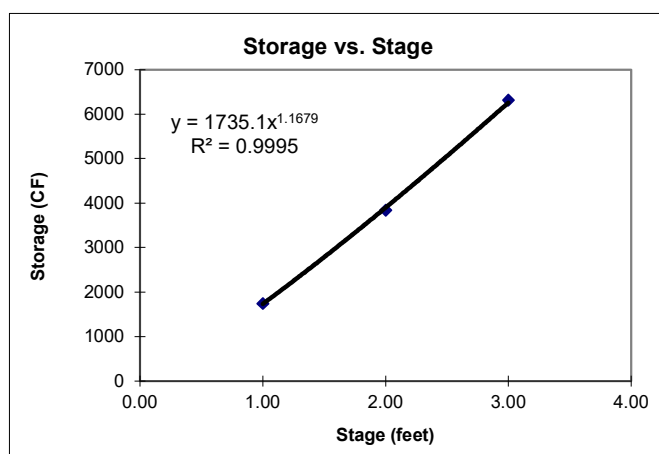
## TOTAL VOLUME OF FACILITY

Volume of Main Pool below Normal Pool=     42,772    cf

Volume of Forebay below Normal Pool=     6,318    cf

Total Volume Below Normal Pool =     49,089    cf

Total Volume Above Normal Pool=     138,048    cf

Total Volume of Facility =     187,137    cf

## FOREBAY PERCENTAGE OF PERMANENT POOL VOLUME

*Per NCDEQ Minimum Design Criteria, the forebay volume should equal*
*approximately 15-20% of the main pool volume.*

Total Main Pool Volume =     42,772    cf

Provided Forebay Volume =     6,318    cf

Provided Forebay Volume % =     15%

## AVERAGE DEPTH OF MAIN POOL

Main Pool Volume at Normal Pool =     42,772    cf

Main Pool Area at Normal Pool =     12,421    sf

Average Depth =     3.44    ft

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'G'**

*Surface Area Calculation*

T. DABOLT
8/2/2021

WET DETENTION BASIN SUMMARY

*Enter the drainage area characteristics ==>*

| | | |
|---|---|---|
| Total drainage area to pond = | 13.66 | acres |
| Total impervious area to pond = | 8.16 | acres |

<u>Note</u>  *The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.*

Drainage area =  **13.66**  acres @  **59.8%**  impervious

*Estimate the surface area required at pond normal pool elevation ==>*

Wet Detention Basins are based on an minimum average depth of  =  **3.44**  feet

| | | 3.0 | 3.44 | 4.0 |
|---|---|---|---|---|
| Lower Boundary => | 50.0 | 1.79 | | 1.51 |
| Site % impervious => | 59.8 | 2.08 | *1.94* | 1.76 |
| Upper Boundary => | 60.0 | 2.09 | | 1.77 |

| Therefore, SA/DA required = | *1.94* |
|---|---|

| | | |
|---|---|---|
| Surface area required for main pool at normal pool = | 11,552 | ft² |
| = | 0.27 | acres |
| Surface area provided for total normal pool = | 15,673 | ft² |
| Surface area provided for main pool at normal pool = | 12,421 | ft² |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'G'**

*WQV Calculation*

T. DABOLT
8/2/2021

## DETERMINATION OF WATER QUALITY VOLUME

$WQ_V = (P)(R_V)(A)/12$

where,

$WQ_V$ = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$ where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

### Input data:

| | | |
|---|---|---|
| Total area, A = | 13.66 | acres |
| Impervious area = | 8.16 | acres |
| Percent impervious cover, I = | 59.8 | % |
| Rainfall, P = | 1.00 | inches |

### Calculated values:

| | | |
|---|---|---|
| $R_V$ = | 0.59 | |
| $WQ_V$ = | 0.67 | acre-ft |
| = | 29149 | cf. |

## ASSOCIATED DEPTH IN POND

| | | |
|---|---|---|
| $WQ_V$ = | 29149 | cf. |

### Stage / Storage Data:

| | | |
|---|---|---|
| Ks = | 17230 | |
| b = | 1.152 | |
| Zo = | 340.00 | |
| Volume in 1" rainfall = | 29149 | cf. |

### Calculated values:

| | | |
|---|---|---|
| Depth of WQv in Basin = | 1.58 | ft |
| = | 18.94 | inches |
| Elevation = | 341.58 | ft |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'G'**
*WQV Drawdown Calculation*

T. DABOLT
8/2/2021

DRAWDOWN ORIFICE DESIGN

|  | |
|---|---|
| D orifice = | 2.5 inch |
| # orifices = | 1 |
| Ks = | 17230 |
| b = | 1.1516 |
| $C_d$ orifice = | 0.60 |
| Normal Pool Elevation = | 340.00 feet |
| Volume @ Normal Pool = | 0 cf |
| Orifice Invert = | 340.00 feet |
| WSEL @ 1" Runoff Volume = | 341.58 feet |

| WSEL (feet) | Vol. Stored (cf) | Orifice Flow (cfs) | Avg. Flow (cfs) | Incr. Vol. (cf) | Incr. Time (sec) |
|---|---|---|---|---|---|
| 341.58 | 29149 | 0.199 | | | |
| 341.44 | 26267 | 0.190 | 0.194 | 2883 | 14839 |
| 341.31 | 23425 | 0.180 | 0.185 | 2842 | 15394 |
| 341.17 | 20628 | 0.169 | 0.174 | 2797 | 16040 |
| 341.03 | 17880 | 0.158 | 0.164 | 2748 | 16804 |
| 340.90 | 15187 | 0.146 | 0.152 | 2693 | 17732 |
| 340.76 | 12556 | 0.133 | 0.139 | 2631 | 18895 |
| 340.62 | 9995 | 0.118 | 0.125 | 2560 | 20421 |
| 340.49 | 7519 | 0.101 | 0.110 | 2476 | 22569 |
| 340.35 | 5147 | 0.081 | 0.091 | 2372 | 25970 |
| 340.21 | 2915 | 0.054 | 0.068 | 2232 | 32940 |

| Drawdown Time = | 2.33 days |
|---|---|

By comparison, if calculated by the average head over the orifice
(assuming average head is one-third the total depth), the result would be:

| | |
|---|---|
| Average driving head on orifice = | 0.492 feet |
| Orifice composite loss coefficient = | 0.600 |
| Cross-sectional area of siphon = | 0.034 sf |
| Q = | 0.1151 cfs |

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

| Drawdown Time = | 2.93 days |
|---|---|

**STORMWATER CONTROL MEASURE 'G'**

*Anti-Flotation Block Calculations*

## RISER ANTI-FLOTATION CALCULATION

**Input Data ==>**

### Safety Factor:

| | | |
|---|---|---|
| Safety factor to use = | 1.15 | (recommend 1.15 or higher) |

### Concrete:

| | | | |
|---|---|---|---|
| Concrete unit weight = | 142.0 | PCF | **Note:** NC Products lists unit wt. of manhole concrete at 142 PCF. |

### Riser:

| | | |
|---|---|---|
| Inside height of Riser = | 5.50 | feet |
| Inside length of riser = | 5.00 | feet |
| Inside width of riser = | 5.00 | feet |
| Wall thickness of riser = | 6.00 | inches |
| Base thickness of riser = | 6.00 | inches |
| Base length of riser = | 6.00 | feet |
| Base width of riser = | 6.00 | feet |

### Openings:

| | | |
|---|---|---|
| Total Orifice Area = | 15.087 | SF |
| OD of barrel exiting manhole = | 44.00 | inches |
| Size of drain pipe (if present) = | 6.0 | inches |

### Trash Rack:

| | | |
|---|---|---|
| Bottom Length = | 8.40 | feet |
| Bottom Width = | 8.40 | feet |
| Top Length = | 2.10 | feet |
| Top Width = | 2.10 | feet |
| Height = | 2.00 | feet |
| Trash Rack water displacement = | 61.74 | CF |

**Concrete Present in Riser Structure ==>**

*Total amount of concrete:*

| | | |
|---|---|---|
| Base of Riser = | 18.00 | CF |
| Riser Walls = | 60.50 | CF |

*Adjust for openings:*

| | | |
|---|---|---|
| Opening for Orifices = | 7.54 | CF |
| Opening for barrel = | 5.28 | CF |
| Opening for drain pipe = | 0.10 | CF |

| | | |
|---|---|---|
| Total Concrete present, adjusted for openings = | *65.579* | *CF* |
| Weight of concrete present = | *9,312* | *lbs* |

THE POINTE
AWH20000

**STORMWATER CONTROL MEASURE 'G'**

*Anti-Flotation Block Calculations*

T. DABOLT
8/2/2021

*Amount of water displaced by Riser Structure ==>*

| | | |
|---|---|---|
| Displacement by concrete = | 65.58 | CF |
| Displacement by open air in riser = | 137.50 | CF |
| Displacement by trash rack = | 61.74 | CF |
| Total water displaced by riser/barrel structure = | **264.82** | **CF** |
| Weight of water displaced = | **16,525** | **lbs** |

*Calculate size of base for riser assembly ==>*

| | | |
|---|---|---|
| Length = | 9.00 | feet |
| Width = | 9.00 | feet |
| Thickness = | 18 | inches |
| Concrete Present = | 121.50 | CF |

*Check validity of base as designed ==>*

| | | |
|---|---|---|
| Total Water Displaced = | 368.32 | CF |
| Total Concrete Present = | 187.08 | CF |
| Total Water Displaced = | 22,983 | lbs |
| Total Concrete Present = | 26,565 | lbs |
| *Actual safety factor =* | *1.16* | **OK** |

*Results of design ==>*

| | | |
|---|---|---|
| Base length = | 9.00 | feet |
| Base width = | 9.00 | feet |
| Base Thickness = | 18.00 | inches |
| CY of concrete total in base = | 4.50 | CY |
| Concrete unit weight in added base >= | 142.0 | PCF |

THE POINTE
AWH20000

**STORMWATER CONTROL MEASURE 'G'**
*Anti-Flotation Block Calculations*

T. DABOLT
8/2/2021

## II. CALCULATION FOR RISER ANTI-FLOTATION STEEL

**Input Data ==>**

| | | |
|---:|---:|:---|
| Anti-Floatation Block Length = | 9.0 | feet |
| Anti-Floatation Block Width = | 9.0 | feet |
| Anti-Floatation Block Thickness = | 18 | inches |
| | | |
| $A_{steel}$ to $A_{concrete}$ Ratio = | 0.0020 | (recommend 0.0018 or hi |

**Cross-Section Calculations==>**

| | | |
|---:|---:|:---|
| Cross-Section Area* = | 13.50 | SF |
| Minimum Steel Area Required = | 0.027 | SF |
| | **3.89** | SI |

*Note: Assumes a "square" x-sec (L and W same)*

**Rebar Calculations ==>**

| Bar Size | 4 | 5 | 6 | 7 | 8 |
|---:|:---:|:---:|:---:|:---:|:---:|
| Diameter (inches) | 0.500 | 0.625 | 0.750 | 0.875 | 1.000 |
| X-Sec Area (SI) | 0.196 | 0.307 | 0.442 | 0.601 | 0.785 |
| Minimum Number of Bars | 20 | 13 | 9 | 7 | 5 |

## DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

| | | | | | |
|---|---|---|---|---|---|
| Project | The Point | | | Date | 11/23/2020 |
| Project No. | AWH-20000 | | | Designer | TKD |
| Outlet ID | SCM G | | | | |

Flow, $Q_{10\text{-yr}}$      20.3    cfs
Slope, S      1.03    %
Pipe Diameter, $D_o$      36    inches
Pipe Diameter, $D_o$      3.0    feet
Number of pipes      1
Pipe separation      0    feet
Manning's n      0.013

**Figure 8.06.b.1**
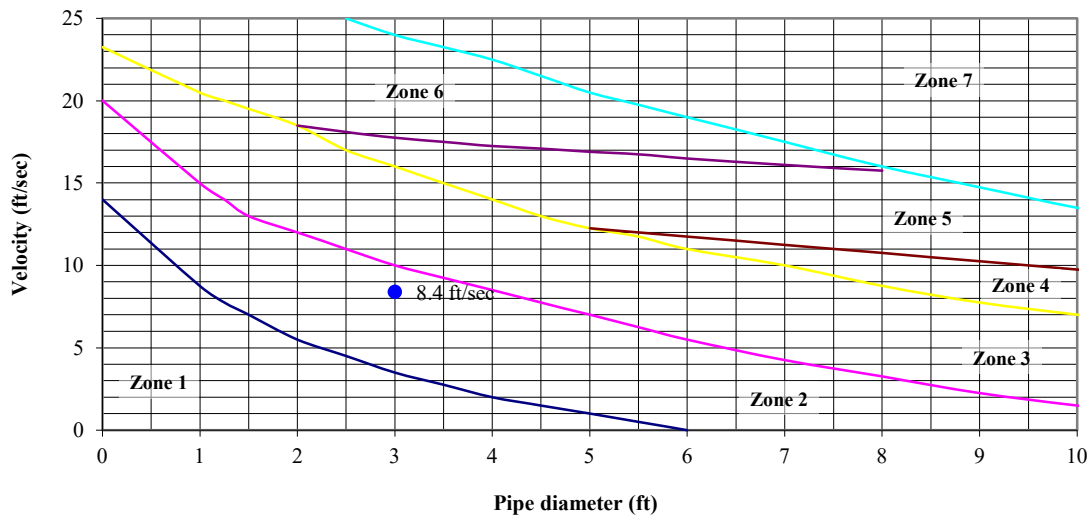


Zone from graph above = _____3_____

| | | | | |
|---|---|---|---|---|
| Outlet pipe diameter | 36 in. | Length = | 24.0 ft. |
| Outlet flowrate | 20.3 cfs | Width = | 9.0 ft. |
| Outlet velocity | 8.4 ft/sec | Stone diameter = | 13 in. |
| Material = | Class I | Thickness = | 22 in. |

| Zone | Material | Diameter | Thickness | Length | Width |
|---|---|---|---|---|---|
| 1 | Class A | 3 | 9 | 4 x D(o) | 3 x D(o) |
| 2 | Class B | 6 | 22 | 6 x D(o) | 3 x D(o) |
| 3 | Class I | 13 | 22 | 8 x D(o) | 3 x D(o) |
| 4 | Class I | 13 | 22 | 8 x D(o) | 3 x D(o) |
| 5 | Class II | 23 | 27 | 10 x D(o) | 3 x D(o) |
| 6 | Class II | 23 | 27 | 10 x D(o) | 3 x D(o) |
| 7 | Special study required | | | | |

1. Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual
2. Outlet velocity based on full-flow velocity

# STORMWATER CONTROL MEASURE 'H'
# DESIGN CALCULATIONS

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'H'**

*SSFxn Above NP*

T. DABOLT
8/2/2021

STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 330.00 | 0.00 | 18,403 | | | | |
| 331.00 | 1.00 | 22,307 | 20355 | 20355 | 20355 | 1.01 |
| 332.00 | 2.00 | 24,345 | 23326 | 23326 | 43681 | 1.97 |
| 334.00 | 4.00 | 28,589 | 26467 | 52934 | 96615 | 3.95 |
| 336.00 | 6.00 | 33,059 | 30824 | 61648 | 158263 | 6.09 |
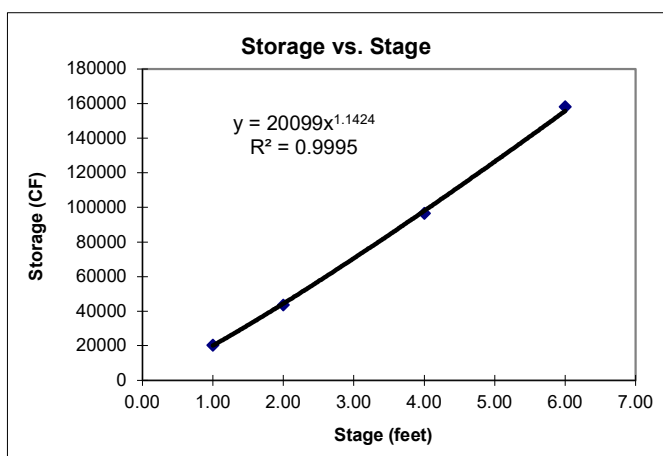
**Storage vs. Stage**

$y = 20099x^{1.1424}$
$R^2 = 0.9995$

| $K_S$ = | 20099 |
|---|---|
| b = | 1.1424 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'H'**

*SSFxn Main Pool*

T. DABOLT
8/2/2021

STAGE-STORAGE FUNCTION - MAIN POOL

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 325.00 | -1.00 | 8,549 | Sediment Storage | | | |
| 326.00 | 0.00 | 9,614 | | | | |
| 327.00 | 1.00 | 10,703 | 10159 | 10159 | 10159 | 1.01 |
| 328.00 | 2.00 | 11,818 | 11261 | 11261 | 21419 | 1.98 |
| 329.00 | 3.00 | 12,958 | 12388 | 12388 | 33807 | 2.98 |
| 330.00 | 4.00 | 14,123 | 13541 | 13541 | 47348 | 4.04 |

*surface area and volume used for avg. depth calculation
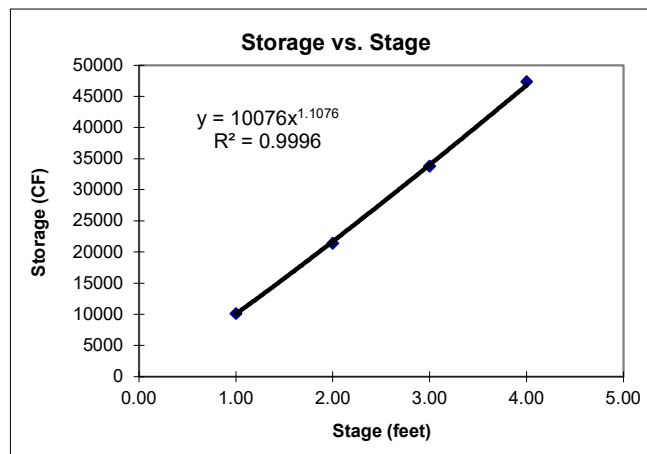


Storage vs. Stage

$y = 10076x^{1.1076}$
$R^2 = 0.9996$

| | |
|---|---|
| $K_S$ = | 10076 |
| b = | 1.1076 |

**STORMWATER CONTROL MEASURE 'H'**
*SSFxn Forebay*

STAGE-STORAGE FUNCTION - FOREBAY

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 326.00 | -1.00 | 2,040 | Sediment Storage | | | |
| 327.00 | 0.00 | 2,389 | | | | |
| 328.00 | 1.00 | 2,763 | 2576 | 2576 | 2576 | 1.00 |
| 329.00 | 2.00 | 3,162 | 2963 | 2963 | 5539 | 1.98 |
| 330.00 | 3.00 | 3,586 | 3374 | 3374 | 8913 | 3.02 |

**Storage vs. Stage**

$y = 2565.1x^{1.1271}$
$R^2 = 0.9997$



| | |
|---|---|
| $K_S$ = | 2565.1 |
| b = | 1.1271 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'H'**

*Volume Calculation*

T. DABOLT
8/2/2021
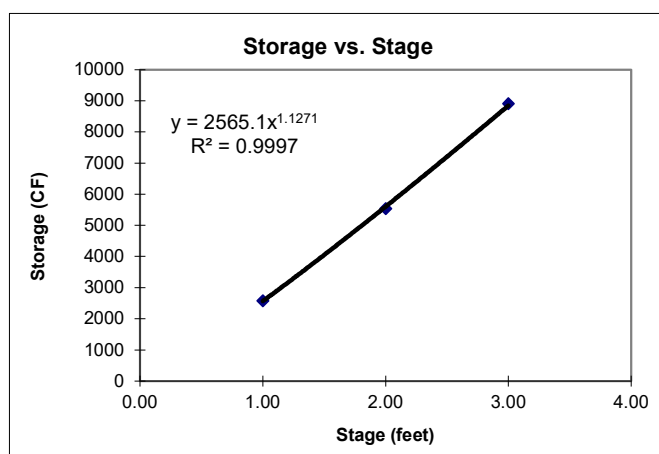
## TOTAL VOLUME OF FACILITY

| | | |
|---|---|---|
| Volume of Main Pool below Normal Pool= | 47,348 | cf |
| Volume of Forebay below Normal Pool= | 8,913 | cf |
| Total Volume Below Normal Pool = | 56,260 | cf |
| Total Volume Above Normal Pool= | 158,263 | cf |
| Total Volume of Facility = | 214,523 | cf |

## FOREBAY PERCENTAGE OF PERMANENT POOL VOLUME

*Per NCDEQ Minimum Design Criteria, the forebay volume should equal approximately 15-20% of the main pool volume.*

| | | |
|---|---|---|
| Total Main Pool Volume = | 47,348 | cf |
| Provided Forebay Volume = | 8,913 | cf |
| Provided Forebay Volume % = | 19% | |

## AVERAGE DEPTH OF MAIN POOL

| | | |
|---|---|---|
| Main Pool Volume at Normal Pool = | 47,348 | cf |
| Main Pool Area at Normal Pool = | 14,123 | sf |
| Average Depth = | 3.35 | ft |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'H'**

*Surface Area Calculation*

T. DABOLT
8/2/2021

WET DETENTION BASIN SUMMARY

*Enter the drainage area characteristics ==>*

| | | |
|---|---|---|
| Total drainage area to pond = | 16.40 | acres |
| Total impervious area to pond = | 9.15 | acres |

*Note*  The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area =  **16.40**  acres @  **55.8%**  impervious

*Estimate the surface area required at pond normal pool elevation ==>*

Wet Detention Basins are based on an minimum average depth of  =  **3.35**  feet

| | | 3.0 | 3.35 | 4.0 |
|---|---|---|---|---|
| Lower Boundary => | 50.0 | 1.79 | | 1.51 |
| Site % impervious => | 55.8 | 1.96 | *1.86* | 1.66 |
| Upper Boundary => | 60.0 | 2.09 | | 1.77 |

| Therefore, SA/DA required = | *1.86* |
|---|---|

| | | |
|---|---|---|
| Surface area required for main pool at normal pool = | 13,269 | ft$^2$ |
| = | 0.30 | acres |
| Surface area provided for total normal pool = | 18,403 | ft$^2$ |
| Surface area provided for main pool at normal pool = | 14,123 | ft$^2$ |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'H'**

*WQV Calculation*

T. DABOLT
8/2/2021

## DETERMINATION OF WATER QUALITY VOLUME

$WQ_V = (P)(R_V)(A)/12$

where,

$WQ_V$ = water quality volume (in acre-ft)
$R_V$ = 0.05+0.009(I) where I is percent impervious cover
A = area in acres
P = rainfall (in inches)

### Input data:

| | | |
|---|---|---|
| Total area, A = | 16.40 | acres |
| Impervious area = | 9.15 | acres |
| Percent impervious cover, I = | 55.8 | % |
| Rainfall, P = | 1.00 | inches |

### Calculated values:

| | | |
|---|---|---|
| $R_V$ = | 0.55 | |
| $WQ_V$ = | 0.75 | acre-ft |
| = | 32877 | cf. |

## ASSOCIATED DEPTH IN POND

| | | |
|---|---|---|
| $WQ_V$ = | 32877 | cf. |

### Stage / Storage Data:

| | | |
|---|---|---|
| Ks = | 20099 | |
| b = | 1.142 | |
| Zo = | 330.00 | |
| Volume in 1" rainfall = | 32877 | cf. |

### Calculated values:

| | | |
|---|---|---|
| Depth of WQv in Basin = | 1.54 | ft |
| = | 18.46 | inches |
| Elevation = | 331.54 | ft |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'H'**
*WQV Drawdown Calculation*

T. DABOLT
8/2/2021

DRAWDOWN ORIFICE DESIGN

| | |
|---|---|
| D orifice = | 2.75 inch |
| # orifices = | 1 |
| Ks = | 20099 |
| b = | 1.1424 |
| $C_d$ orifice = | 0.60 |
| Normal Pool Elevation = | 330.00 feet |
| Volume @ Normal Pool = | 0 cf |
| Orifice Invert = | 330.00 feet |
| WSEL @ 1" Runoff Volume = | 331.54 feet |

| WSEL (feet) | Vol. Stored (cf) | Orifice Flow (cfs) | Avg. Flow (cfs) | Incr. Vol. (cf) | Incr. Time (sec) |
|---|---|---|---|---|---|
| 331.54 | 32877 | 0.237 | | | |
| 331.41 | 29643 | 0.225 | 0.231 | 3235 | 14008 |
| 331.27 | 26451 | 0.213 | 0.219 | 3191 | 14554 |
| 331.14 | 23307 | 0.201 | 0.207 | 3144 | 15191 |
| 331.01 | 20215 | 0.187 | 0.194 | 3092 | 15948 |
| 330.87 | 17181 | 0.173 | 0.180 | 3034 | 16871 |
| 330.74 | 14213 | 0.157 | 0.165 | 2968 | 18036 |
| 330.61 | 11321 | 0.139 | 0.148 | 2892 | 19578 |
| 330.47 | 8518 | 0.118 | 0.129 | 2802 | 21778 |
| 330.34 | 5828 | 0.094 | 0.106 | 2690 | 25346 |
| 330.21 | 3288 | 0.057 | 0.075 | 2540 | 33692 |

| Drawdown Time = | 2.26 days |
|---|---|

By comparison, if calculated by the average head over the orifice
(assuming average head is one-third the total depth), the result would be:

| | |
|---|---|
| Average driving head on orifice = | 0.475 feet |
| Orifice composite loss coefficient = | 0.600 |
| Cross-sectional area of siphon = | 0.041 sf |
| Q = | 0.1368 cfs |

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

| Drawdown Time = | 2.78 days |
|---|---|

### RISER ANTI-FLOTATION CALCULATION

*Input Data ==>*

*Safety Factor:*

| | | |
|---|---|---|
| Safety factor to use = | 1.15 | (recommend 1.15 or higher) |

*Concrete:*

| | | |
|---|---|---|
| Concrete unit weight = | 142.0 PCF | **Note:** NC Products lists unit wt. of manhole concrete at 142 PCF. |

*Riser:*

| | |
|---|---|
| Inside height of Riser = | 5.50 feet |
| Inside length of riser = | 6.00 feet |
| Inside width of riser = | 6.00 feet |
| Wall thickness of riser = | 6.00 inches |
| Base thickness of riser = | 6.00 inches |
| Base length of riser = | 7.00 feet |
| Base width of riser = | 7.00 feet |

*Openings:*

| | |
|---|---|
| Total Orifice Area = | 7.665 SF |
| OD of barrel exiting manhole = | 51.00 inches |
| Size of drain pipe (if present) = | 6.0 inches |

*Trash Rack:*

| | |
|---|---|
| Bottom Length = | 7.00 feet |
| Bottom Width = | 7.00 feet |
| Top Length = | 1.00 feet |
| Top Width = | 1.00 feet |
| Height = | 2.00 feet |
| Trash Rack water displacement = | 38.00 CF |

*Concrete Present in Riser Structure ==>*

*Total amount of concrete:*

| | |
|---|---|
| Base of Riser = | 24.50 CF |
| Riser Walls = | 71.50 CF |

*Adjust for openings:*

| | |
|---|---|
| Opening for Orifices = | 3.83 CF |
| Opening for barrel = | 7.09 CF |
| Opening for drain pipe = | 0.10 CF |

| | |
|---|---|
| Total Concrete present, adjusted for openings = | *84.976* **CF** |
| Weight of concrete present = | *12,067* **lbs** |

THE POINTE
AWH20000

**STORMWATER CONTROL MEASURE 'H'**

*Anti-Flotation Block Calculations*

T. DABOLT
8/2/2021

*Amount of water displaced by Riser Structure ==>*

| | | |
|---|---|---|
| Displacement by concrete = | 84.98 | CF |
| Displacement by open air in riser = | 198.00 | CF |
| Displacement by trash rack = | 38.00 | CF |
| Total water displaced by riser/barrel structure = | **320.98** | **CF** |
| Weight of water displaced = | **20,029** | **lbs** |

*Calculate size of base for riser assembly ==>*

| | | |
|---|---|---|
| Length = | 10.00 | feet |
| Width = | 10.00 | feet |
| Thickness = | 24 | inches |
| Concrete Present = | 200.00 | CF |

*Check validity of base as designed ==>*

| | | |
|---|---|---|
| Total Water Displaced = | 496.48 | CF |
| Total Concrete Present = | 284.98 | CF |
| Total Water Displaced = | 30,980 | lbs |
| Total Concrete Present = | 40,467 | lbs |
| *Actual safety factor =* | *1.31* | OK |

*Results of design ==>*

| | | |
|---|---|---|
| Base length = | 10.00 | feet |
| Base width = | 10.00 | feet |
| Base Thickness = | 24.00 | inches |
| CY of concrete total in base = | 7.41 | CY |
| Concrete unit weight in added base >= | 142.0 | PCF |

THE POINTE
AWH20000

**STORMWATER CONTROL MEASURE 'H'**
*Anti-Flotation Block Calculations*

T. DABOLT
8/2/2021

## II.  CALCULATION FOR RISER ANTI-FLOTATION STEEL

**Input Data ==>**

|  |  |  |
|---|---|---|
| Anti-Floatation Block Length = | 10.0 | feet |
| Anti-Floatation Block Width = | 10.0 | feet |
| Anti-Floatation Block Thickness = | 24 | inches |
| $A_{steel}$ to $A_{concrete}$ Ratio = | 0.0020 | (recommend 0.0018 or hi |

**Cross-Section Calculations==>**

|  |  |  |
|---|---|---|
| Cross-Section Area* = | 20.00 | SF |
| Minimum Steel Area Required = | 0.040 | SF |
|  | **5.76** | SI |

*Note:  Assumes a "square" x-sec (L and W same)*

**Rebar Calculations ==>**

| Bar Size | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|
| Diameter (inches) | 0.500 | 0.625 | 0.750 | 0.875 | 1.000 |
| X-Sec Area (SI) | 0.196 | 0.307 | 0.442 | 0.601 | 0.785 |
| Minimum Number of Bars | 30 | 19 | 14 | 10 | 8 |

## DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

| | | | | | |
|---|---|---|---|---|---|
| Project | The Point | | Date | 11/23/2020 | |
| Project No. | AWH-20000 | | Designer | TKD | |
| Outlet ID | SCM H | | | | |

Flow, $Q_{10\text{-yr}}$     23.5     cfs
Slope, S     1.25     %
Pipe Diameter, $D_o$     42     inches
Pipe Diameter, $D_o$     3.5     feet
Number of pipes     1
Pipe separation     0     feet
Manning's n     0.013



**Figure 8.06.b.1**
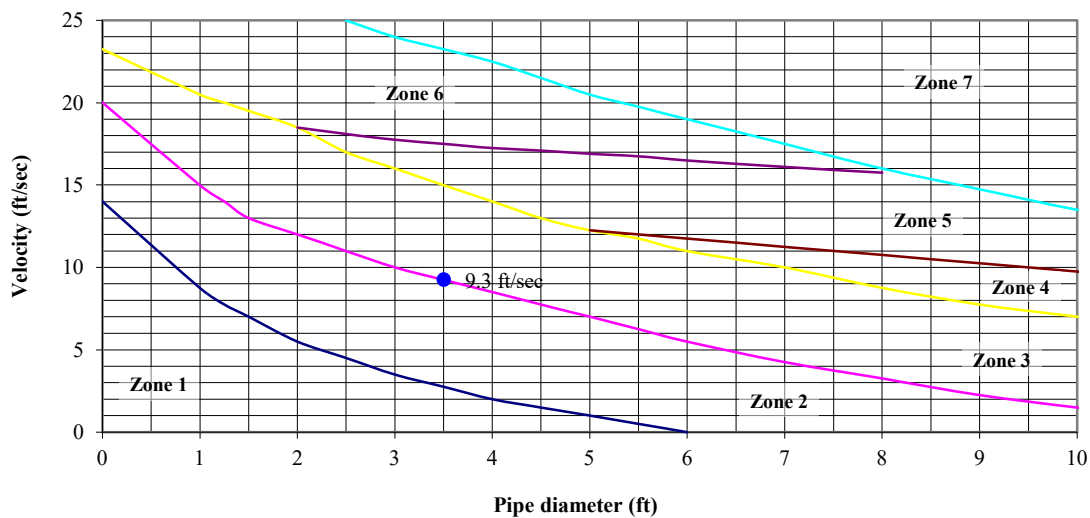
Zone from graph above = _____3_____

| | | | | |
|---|---|---|---|---|
| Outlet pipe diameter | 42 in. | Length = | 28.0 ft. |
| Outlet flowrate | 23.5 cfs | Width = | 10.5 ft. |
| Outlet velocity | 9.3 ft/sec | Stone diameter = | 13 in. |
| Material = | Class I | Thickness = | 22 in. |

| Zone | Material | Diameter | Thickness | Length | Width |
|---|---|---|---|---|---|
| 1 | Class A | 3 | 9 | 4 x D(o) | 3 x D(o) |
| 2 | Class B | 6 | 22 | 6 x D(o) | 3 x D(o) |
| 3 | Class I | 13 | 22 | 8 x D(o) | 3 x D(o) |
| 4 | Class I | 13 | 22 | 8 x D(o) | 3 x D(o) |
| 5 | Class II | 23 | 27 | 10 x D(o) | 3 x D(o) |
| 6 | Class II | 23 | 27 | 10 x D(o) | 3 x D(o) |
| 7 | Special study required | | | | |

1. Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual
2. Outlet velocity based on full-flow velocity

# STORMWATER CONTROL MEASURE 'I' DESIGN CALCULATIONS

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'I'**

*SSFxn Above NP*

T. DABOLT
8/2/2021

STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 318.00 | 0.00 | 7,619 | | | | |
| 319.00 | 1.00 | 10,306 | 8963 | 8963 | 8963 | 1.01 |
| 320.00 | 2.00 | 11,734 | 11020 | 11020 | 19983 | 1.98 |
| 322.00 | 4.00 | 13,880 | 12807 | 25614 | 45597 | 3.97 |
| 324.00 | 6.00 | 15,964 | 14922 | 29844 | 75441 | 6.06 |
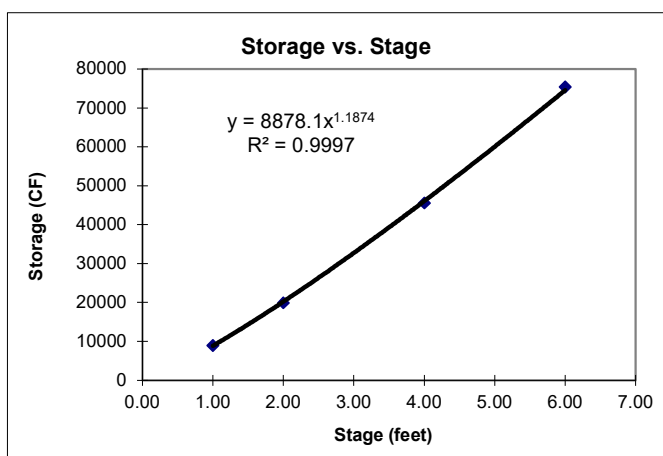
**Storage vs. Stage**

$y = 8878.1x^{1.1874}$

$R^2 = 0.9997$

Storage (CF) vs. Stage (feet)

| $K_S =$ | 8878 |
|---|---|
| $b =$ | 1.1874 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'I'**

*SSFxn Main Pool*

T. DABOLT
8/2/2021

STAGE-STORAGE FUNCTION - MAIN POOL

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 308.50 | -0.50 | 732 | Sediment Storage | | | |
| 309.00 | 0.00 | 866 | | | | |
| 315.00 | 6.00 | 3,503 | 2185 | 13107 | 13107 | 6.01 |
| 316.00 | 7.00 | 4,029 | 3766 | 3766 | 16873 | 6.98 |
| 317.00 | 8.00 | 4,580 | 4305 | 4305 | 21178 | 7.98 |
| 318.00 | 9.00 | 5,157 | 4869 | 4869 | 26046 | 9.02 |

*surface area and volume used for avg. depth calculation*
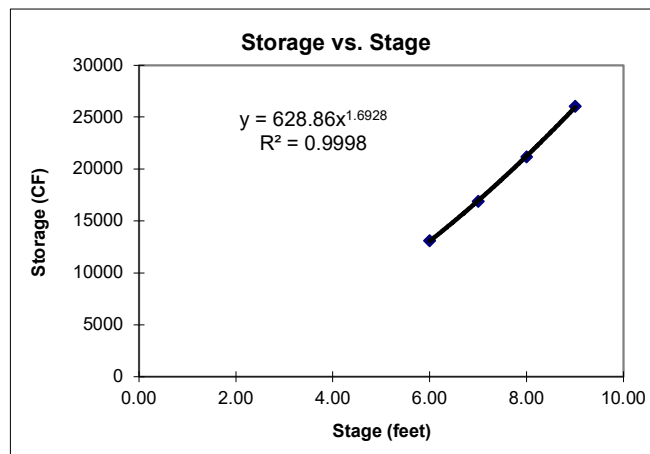
**Storage vs. Stage**

$y = 628.86x^{1.6928}$
$R^2 = 0.9998$

Storage (CF) vs. Stage (feet)

| | |
|---|---|
| $K_S =$ | 629 |
| $b =$ | 1.6928 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'I'**
*SSFxn Forebay*

T. DABOLT
8/2/2021

STAGE-STORAGE FUNCTION - FOREBAY

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 340.50 | -0.50 | 22 | | Sediment Storage | | |
| 341.00 | 0.00 | 42 | | | | |
| 342.00 | 1.00 | 101 | 72 | 72 | 72 | 1.01 |
| 343.50 | 2.50 | 290 | 196 | 293 | 365 | 2.41 |
| 344.00 | 3.00 | 577 | 434 | 217 | 582 | 3.09 |

**Storage vs. Stage**

$y = 70.688x^{1.8659}$
$R^2 = 0.9887$

| | |
|---|---|
| $K_S =$ | 70.7 |
| $b =$ | 1.8659 |

THE POINT
AWH-20000
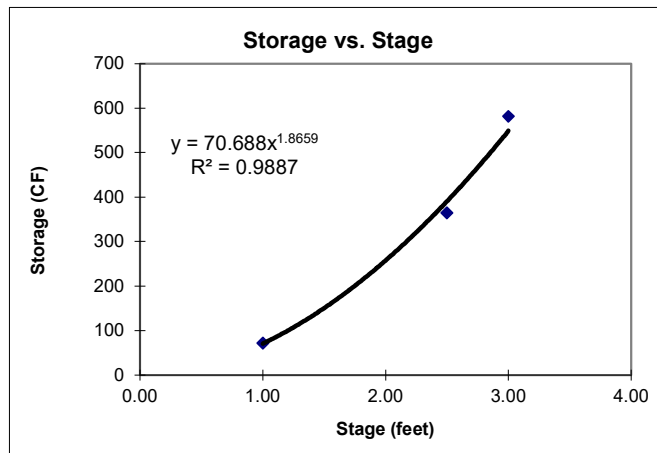
**STORMWATER CONTROL MEASURE 'I'**

*SSFxn Forebay (2)*

T. DABOLT
8/2/2021

STAGE-STORAGE FUNCTION - FOREBAY

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 311.50 | -0.50 | 69 | | | | |
| 312.00 | 0.00 | 109 | | Sediment Storage | | |
| 316.00 | 4.00 | 647 | 378 | 1512 | 1512 | 4.01 |
| 317.00 | 5.00 | 844 | 746 | 746 | 2258 | 4.98 |
| 318.00 | 6.00 | 1,066 | 955 | 955 | 3213 | 6.02 |

**Storage vs. Stage**

$y = 114.84x^{1.8563}$
$R^2 = 0.9995$

Storage (CF) vs Stage (feet)

| | |
|---|---|
| $K_s =$ | 114.8 |
| $b =$ | 1.8563 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'I'**

*Volume Calculation*

T. DABOLT
8/2/2021
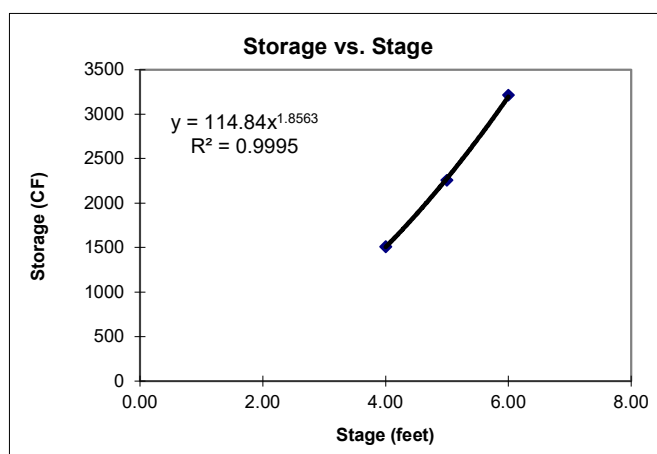
## TOTAL VOLUME OF FACILITY

| | | |
|---|---|---|
| Volume of Main Pool below Normal Pool= | 26,046 | cf |
| Volume of Forebay below Normal Pool= | 3,794 | cf |
| Total Volume Below Normal Pool = | 29,840 | cf |
| Total Volume Above Normal Pool= | 75,441 | cf |
| Total Volume of Facility = | 105,281 | cf |

## FOREBAY PERCENTAGE OF PERMANENT POOL VOLUME

*Per NCDEQ Minimum Design Criteria, the forebay volume should equal approximately 15-20% of the main pool volume.*

| | | |
|---|---|---|
| Total Main Pool Volume = | 26,046 | cf |
| Provided Forebay Volume = | 3,794 | cf |
| Provided Forebay Volume % = | 15% | |

## AVERAGE DEPTH OF MAIN POOL

| | | |
|---|---|---|
| Main Pool Volume at Normal Pool = | 26,046 | cf |
| Main Pool Area at Normal Pool = | 5,157 | sf |
| Average Depth = | 5.05 | ft |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'I'**

*Surface Area Calculation*

T. DABOLT
8/2/2021

WET DETENTION BASIN SUMMARY

*Enter the drainage area characteristics ==>*

| | | |
|---|---|---|
| Total drainage area to pond = | 8.37 | acres |
| Total impervious area to pond = | 4.54 | acres |

<u>Note</u>   *The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.*

Drainage area =   **8.37**   acres @   **54.3%**   impervious

*Estimate the surface area required at pond normal pool elevation ==>*

Wet Detention Basins are based on an minimum average depth of  =   **5.05**   feet *(Hard Coded)*

| | | 5.0 | 5.05 | 6.0 |
|---|---|---|---|---|
| Lower Boundary => | 50.0 | 1.31 | | 1.13 |
| Site % impervious => | 54.3 | 1.39 | *1.38* | 1.21 |
| Upper Boundary => | 60.0 | 1.49 | | 1.31 |

Therefore, SA/DA required =   *1.38*

| | | | |
|---|---|---|---|
| Surface area required for main pool at normal pool = | 5,024 | ft$^2$ | 6782.306 |
| = | 0.12 | acres | |
| Surface area provided for total normal pool = | 7,619 | ft$^2$ | |
| Surface area estimate for main pool at normal pool = | 5,157 | ft$^2$ | |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'I'**

*WQV Calculation*

T. DABOLT
8/2/2021

## DETERMINATION OF WATER QUALITY VOLUME

$WQ_V = (P)(R_V)(A)/12$

where,

$WQ_V$ = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$ where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

### Input data:

| | | |
|---|---|---|
| Total area, A = | 8.37 | acres |
| Impervious area = | 4.54 | acres |
| Percent impervious cover, I = | 54.3 | % |
| Rainfall, P = | 1.00 | inches |

### Calculated values:

| | | |
|---|---|---|
| $R_V$ = | 0.54 | |
| $WQ_V$ = | 0.38 | acre-ft |
| = | 16362 | cf. |

## ASSOCIATED DEPTH IN POND

| | | |
|---|---|---|
| $WQ_V$ = | 16362 | cf. |

### Stage / Storage Data:

| | | |
|---|---|---|
| Ks = | 8878 | |
| b = | 1.187 | |
| Zo = | 318.00 | |
| Volume in 1" rainfall = | 16362 | cf. |

### Calculated values:

| | | |
|---|---|---|
| Depth of WQv in Basin = | 1.67 | ft |
| = | 20.08 | inches |
| Elevation = | 319.67 | ft |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'I'**
*WQV Drawdown Calculation*

T. DABOLT
8/2/2021

DRAWDOWN ORIFICE DESIGN

| | | |
|---|---:|---|
| D orifice = | 1.75 | inch |
| # orifices = | 1 | |
| Ks = | 8878 | |
| b = | 1.1874 | |
| $C_d$ orifice = | 0.60 | |
| Normal Pool Elevation = | 318.00 | feet |
| Volume @ Normal Pool = | 0 | cf |
| Orifice Invert = | 318.00 | feet |
| WSEL @ 1" Runoff Volume = | 319.67 | feet |

| WSEL (feet) | Vol. Stored (cf) | Orifice Flow (cfs) | Avg. Flow (cfs) | Incr. Vol. (cf) | Incr. Time (sec) |
|---|---|---|---|---|---|
| 319.67 | 16362 | 0.102 | | | |
| 319.53 | 14712 | 0.097 | 0.099 | 1650 | 16620 |
| 319.39 | 13091 | 0.092 | 0.094 | 1621 | 17155 |
| 319.24 | 11501 | 0.087 | 0.089 | 1590 | 17771 |
| 319.10 | 9945 | 0.081 | 0.084 | 1556 | 18492 |
| 318.96 | 8427 | 0.076 | 0.078 | 1518 | 19354 |
| 318.81 | 6951 | 0.069 | 0.072 | 1476 | 20414 |
| 318.67 | 5523 | 0.062 | 0.066 | 1428 | 21769 |
| 318.53 | 4152 | 0.054 | 0.058 | 1372 | 23607 |
| 318.38 | 2849 | 0.045 | 0.049 | 1303 | 26341 |
| 318.24 | 1636 | 0.033 | 0.039 | 1213 | 31228 |

| Drawdown Time = | 2.46 days |
|---|---|

By comparison, if calculated by the average head over the orifice
(assuming average head is one-third the total depth), the result would be:

| | | |
|---|---:|---|
| Average driving head on orifice = | 0.534 | feet |
| Orifice composite loss coefficient = | 0.600 | |
| Cross-sectional area of siphon = | 0.017 | sf |
| Q = | 0.0587 | cfs |

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

| Drawdown Time = | 3.22 days |
|---|---|

### RISER ANTI-FLOTATION CALCULATION

**Input Data ==>**

**Safety Factor:**

| | | |
|---|---|---|
| Safety factor to use = | 1.15 | (recommend 1.15 or higher) |

**Concrete:**

| | | | |
|---|---|---|---|
| Concrete unit weight = | 142.0 | PCF | **Note:** NC Products lists unit wt. of manhole concrete at 142 PCF. |

**Riser:**

| | | |
|---|---|---|
| Inside height of Riser = | 6.00 | feet |
| Inside length of riser = | 5.00 | feet |
| Inside width of riser = | 5.00 | feet |
| Wall thickness of riser = | 6.00 | inches |
| Base thickness of riser = | 6.00 | inches |
| Base length of riser = | 6.00 | feet |
| Base width of riser = | 6.00 | feet |

**Openings:**

| | | |
|---|---|---|
| Total Orifice Area = | 9.017 | SF |
| OD of barrel exiting manhole = | 44.00 | inches |
| Size of drain pipe (if present) = | 6.0 | inches |

**Trash Rack:**

| | | |
|---|---|---|
| Bottom Length = | 8.40 | feet |
| Bottom Width = | 8.40 | feet |
| Top Length = | 2.10 | feet |
| Top Width = | 2.10 | feet |
| Height = | 2.00 | feet |
| Trash Rack water displacement = | 61.74 | CF |

**Concrete Present in Riser Structure ==>**

*Total amount of concrete:*

| | | |
|---|---|---|
| Base of Riser = | 18.00 | CF |
| Riser Walls = | 66.00 | CF |

*Adjust for openings:*

| | | |
|---|---|---|
| Opening for Orifices = | 4.51 | CF |
| Opening for barrel = | 5.28 | CF |
| Opening for drain pipe = | 0.10 | CF |

| | | |
|---|---|---|
| Total Concrete present, adjusted for openings = | *74.114* | *CF* |
| Weight of concrete present = | *10,524* | *lbs* |

*Amount of water displaced by Riser Structure ==>*

| | | |
|---|---|---|
| Displacement by concrete = | 74.11 | CF |
| Displacement by open air in riser = | 150.00 | CF |
| Displacement by trash rack = | 61.74 | CF |
| | | |
| Total water displaced by riser/barrel structure = | **285.85** | **CF** |
| Weight of water displaced = | **17,837** | **lbs** |

*Calculate size of base for riser assembly ==>*

| | | |
|---|---|---|
| Length = | 9.00 | feet |
| Width = | 9.00 | feet |
| Thickness = | 24 | inches |
| | | |
| Concrete Present = | 162.00 | CF |

*Check validity of base as designed ==>*

| | | |
|---|---|---|
| Total Water Displaced = | 429.85 | CF |
| Total Concrete Present = | 236.11 | CF |
| | | |
| Total Water Displaced = | 26,823 | lbs |
| Total Concrete Present = | 33,528 | lbs |
| | | |
| *Actual safety factor =* | *1.25* | **OK** |

*Results of design ==>*

| | | |
|---|---|---|
| Base length = | 9.00 | feet |
| Base width = | 9.00 | feet |
| Base Thickness = | 24.00 | inches |
| CY of concrete total in base = | 6.00 | CY |
| Concrete unit weight in added base >= | 142.0 | PCF |

THE POINT
AWH20000

**STORMWATER CONTROL MEASURE 'F'**

*Anti-Flotation Block Calculations*

T. DABOLT
8/2/2021

## II. CALCULATION FOR RISER ANTI-FLOTATION STEEL

**Input Data ==>**

| | | |
|---:|:---:|:---|
| Anti-Floatation Block Length = | 9.0 | feet |
| Anti-Floatation Block Width = | 9.0 | feet |
| Anti-Floatation Block Thickness = | 24 | inches |
| | | |
| $A_{steel}$ to $A_{concrete}$ Ratio = | 0.0020 | (recommend 0.0018 or hi |

**Cross-Section Calculations==>**

| | | |
|---:|:---:|:---|
| Cross-Section Area* = | 18.00 | SF |
| Minimum Steel Area Required = | 0.036 | SF |
| | **5.18** | SI |

*Note: Assumes a "square" x-sec (L and W same)*

**Rebar Calculations ==>**

| Bar Size | 4 | 5 | 6 | 7 | 8 |
|---:|:---:|:---:|:---:|:---:|:---:|
| Diameter (inches) | 0.500 | 0.625 | 0.750 | 0.875 | 1.000 |
| X-Sec Area (SI) | 0.196 | 0.307 | 0.442 | 0.601 | 0.785 |
| Minimum Number of Bars | 27 | 17 | 12 | 9 | 7 |

## DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

| | | | | | |
|---|---|---|---|---|---|
| Project | The Point | | | Date | 11/23/2020 |
| Project No. | AWH-20000 | | | Designer | TKD |
| Outlet ID | SCM F | | | | |

| | | |
|---|---|---|
| Flow, $Q_{10\text{-yr}}$ | 15.2 | cfs |
| Slope, S | 2.06 | % |
| Pipe Diameter, $D_o$ | 36 | inches |
| Pipe Diameter, $D_o$ | 3.0 | feet |
| Number of pipes | 1 | |
| Pipe separation | 0 | feet |
| Manning's n | 0.013 | |

**Figure 8.06.b.1**
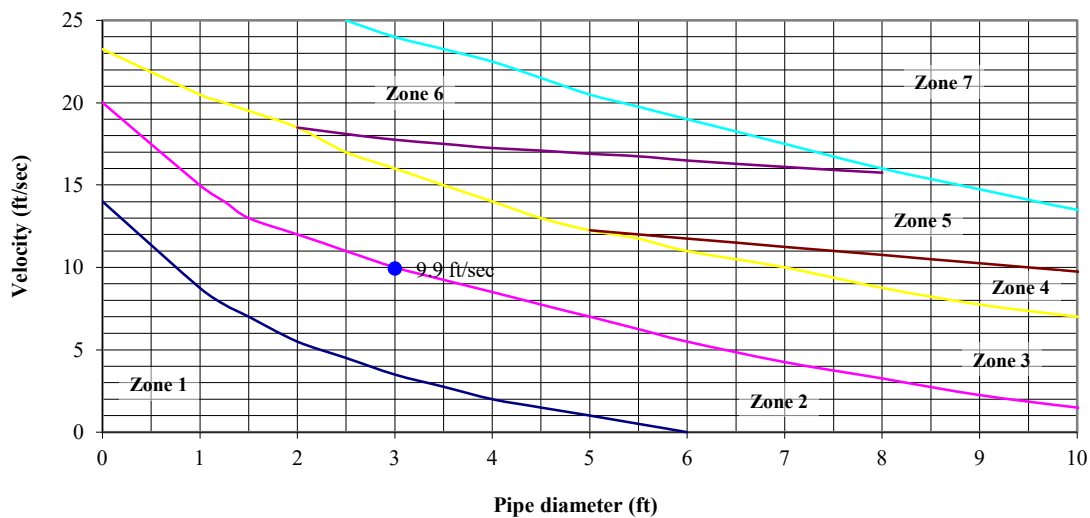


Zone from graph above = 3

| | | | | |
|---|---|---|---|---|
| Outlet pipe diameter | 36 in. | Length = | 24.0 ft. |
| Outlet flowrate | 15.2 cfs | Width = | 9.0 ft. |
| Outlet velocity | 9.9 ft/sec | Stone diameter = | 13 in. |
| Material = | Class I | Thickness = | 22 in. |

| Zone | Material | Diameter | Thickness | Length | Width |
|---|---|---|---|---|---|
| 1 | Class A | 3 | 9 | 4 x D(o) | 3 x D(o) |
| 2 | Class B | 6 | 22 | 6 x D(o) | 3 x D(o) |
| 3 | Class I | 13 | 22 | 8 x D(o) | 3 x D(o) |
| 4 | Class I | 13 | 22 | 8 x D(o) | 3 x D(o) |
| 5 | Class II | 23 | 27 | 10 x D(o) | 3 x D(o) |
| 6 | Class II | 23 | 27 | 10 x D(o) | 3 x D(o) |
| 7 | Special study required | | | | |

1. Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual
2. Outlet velocity based on full-flow velocity

# STORMWATER CONTROL MEASURE 'J'
# DESIGN CALCULATIONS

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'J'**

*SSFxn Above NP*

T. DABOLT
8/2/2021

STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 310.00 | 0.00 | 11,895 | | | | |
| 311.00 | 1.00 | 15,511 | 13703 | 13703 | 13703 | 1.01 |
| 312.00 | 2.00 | 17,403 | 16457 | 16457 | 30160 | 1.97 |
| 314.00 | 4.00 | 21,358 | 19381 | 38761 | 68921 | 3.94 |
| 316.00 | 6.00 | 25,539 | 23449 | 46897 | 115818 | 6.10 |

**Storage vs. Stage**

$y = 13490x^{1.1886}$
$R^2 = 0.9993$

| | |
|---|---|
| $K_S =$ | 13490 |
| $b =$ | 1.1886 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'J'**

*SSFxn Main Pool*

T. DABOLT
8/2/2021

## STAGE-STORAGE FUNCTION - MAIN POOL

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 303.50 | -0.50 | 3,710 | Sediment Storage | | | |
| 304.00 | 0.00 | 4,077 | | | | |
| 307.00 | 3.00 | 6,414 | 5246 | 15737 | 15737 | 3.01 |
| 308.00 | 4.00 | 7,243 | 6829 | 6829 | 22565 | 3.98 |
| 309.00 | 5.00 | 8,097 | 7670 | 7670 | 30235 | 4.98 |
| 310.00 | 6.00 | 8,977 | 8537 | 8537 | 38772 | 6.03 |

*surface area and volume used for avg. depth calculation



Storage vs. Stage

$y = 3753.6x^{1.2994}$
$R^2 = 0.9996$

| | |
|---|---|
| $K_S =$ | 3754 |
| $b =$ | 1.2994 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'J'**
*SSFxn Forebay*

T. DABOLT
8/2/2021
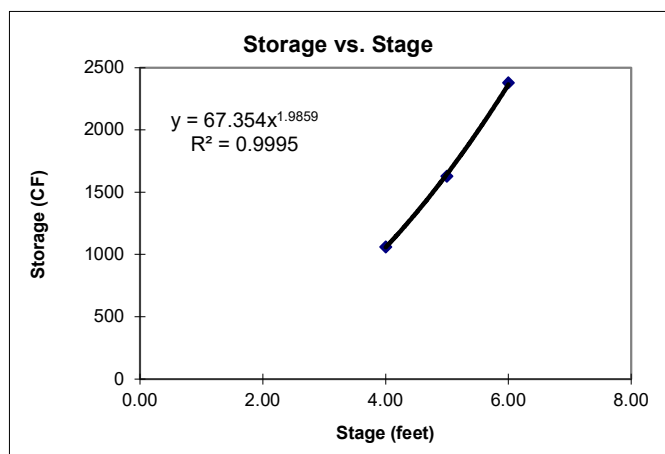
STAGE-STORAGE FUNCTION - FOREBAY

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 303.50 | -0.50 | 62 | | Sediment Storage | | |
| 304.00 | 0.00 | 105 | | | | |
| 308.00 | 4.00 | 679 | 392 | 1568 | 1568 | 4.01 |
| 309.00 | 5.00 | 886 | 783 | 783 | 2351 | 4.98 |
| 310.00 | 6.00 | 1,117 | 1002 | 1002 | 3352 | 6.02 |
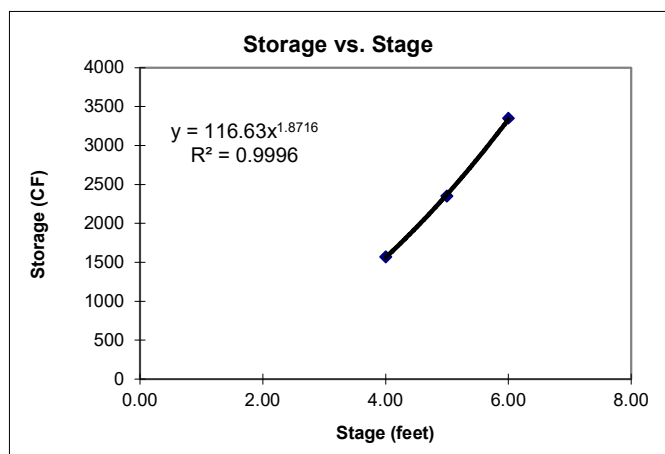
**Storage vs. Stage**

$y = 116.63x^{1.8716}$
$R^2 = 0.9996$

Storage (CF) vs. Stage (feet)

| | |
|---|---|
| $K_S =$ | 116.6 |
| $b =$ | 1.8716 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'J'**

*SSFxn Forebay (2)*

T. DABOLT
8/2/2021

STAGE-STORAGE FUNCTION - FOREBAY

| Contour (feet) | Stage (feet) | Contour Area (SF) | Average Contour Area (SF) | Incremental Contour Volume (CF) | Accumulated Contour Volume (CF) | Estimated Stage w/ S-S Fxn (feet) |
|---|---|---|---|---|---|---|
| 304.00 | 0.00 | 22 | | Sediment Storage | | |
| 304.00 | 0.00 | 50 | | | | |
| 308.00 | 4.00 | 481 | 266 | 1062 | 1062 | 4.01 |
| 309.00 | 5.00 | 652 | 567 | 567 | 1629 | 4.97 |
| 310.00 | 6.00 | 848 | 750 | 750 | 2379 | 6.02 |

**Storage vs. Stage**

$y = 67.354x^{1.9859}$
$R^2 = 0.9995$

| | |
|---|---|
| $K_S =$ | 67.4 |
| $b =$ | 1.9859 |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'J'**

*Volume Calculation*

T. DABOLT
8/2/2021

## TOTAL VOLUME OF FACILITY

| | | |
|---|---|---|
| Volume of Main Pool below Normal Pool= | 38,772 | cf |
| Volume of Forebay below Normal Pool= | 5,731 | cf |
| Total Volume Below Normal Pool = | 44,503 | cf |
| Total Volume Above Normal Pool= | 115,818 | cf |
| Total Volume of Facility = | 160,321 | cf |

## FOREBAY PERCENTAGE OF PERMANENT POOL VOLUME

*Per NCDEQ Minimum Design Criteria, the forebay volume should equal
approximately 15-20% of the main pool volume.*

| | | |
|---|---|---|
| Total Main Pool Volume = | 38,772 | cf |
| Provided Forebay Volume = | 5,731 | cf |
| Provided Forebay Volume % = | 15% | |

## AVERAGE DEPTH OF MAIN POOL

| | | |
|---|---|---|
| Main Pool Volume at Normal Pool = | 38,772 | cf |
| Main Pool Area at Normal Pool = | 8,977 | sf |
| Average Depth = | 4.32 | ft |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'J'**

*Surface Area Calculation*

T. DABOLT
8/2/2021

WET DETENTION BASIN SUMMARY

*Enter the drainage area characteristics ==>*

|  |  |  |
|---|---|---|
| Total drainage area to pond = | 14.19 | acres |
| Total impervious area to pond = | 6.69 | acres |

<u>Note</u>  *The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.*

Drainage area =　**14.19**　acres @　**47.2%**　impervious

*Estimate the surface area required at pond normal pool elevation ==>*

Wet Detention Basins are based on an minimum average depth of  =　**4.32**　feet

|  |  | 4.0 | 4.32 | 5.0 |
|---|---|---|---|---|
| Lower Boundary => | 40.0 | 1.24 |  | 1.09 |
| Site % impervious => | 47.2 | 1.43 | *1.37* | 1.25 |
| Upper Boundary => | 50.0 | 1.51 |  | 1.31 |

| Therefore, SA/DA required = | *1.37* |
|---|---|

| | | |
|---|---|---|
| Surface area required for main pool at normal pool = | 8,495 | ft$^2$ |
| = | 0.20 | acres |
| Surface area provided for total normal pool = | 11,895 | ft$^2$ |
| Surface area provided for main pool at normal pool = | 8,977 | ft$^2$ |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'J'**

*WQV Calculation*

T. DABOLT
8/2/2021

DETERMINATION OF WATER QUALITY VOLUME

$WQ_V = (P)(R_V)(A)/12$

where,

$WQ_V$ = water quality volume (in acre-ft)

$R_V = 0.05+0.009(I)$ where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

*Input data:*

| | | |
|---|---|---|
| Total area, A = | 14.19 | acres |
| Impervious area = | 6.69 | acres |
| Percent impervious cover, I = | 47.2 | % |
| Rainfall, P = | 1.00 | inches |

*Calculated values:*

| | | |
|---|---|---|
| $R_V$ = | 0.47 | |
| $WQ_V$ = | 0.56 | acre-ft |
| = | 24443 | cf. |

ASSOCIATED DEPTH IN POND

| | | |
|---|---|---|
| $WQ_V$ = | 24443 | cf. |

*Stage / Storage Data:*

| | | |
|---|---|---|
| Ks = | 13490 | |
| b = | 1.189 | |
| Zo = | 310.00 | |
| Volume in 1" rainfall = | 24443 | cf. |

*Calculated values:*

| | | |
|---|---|---|
| Depth of WQv in Basin = | 1.65 | ft |
| = | 19.79 | inches |
| Elevation = | 311.65 | ft |

THE POINT
AWH-20000

**STORMWATER CONTROL MEASURE 'J'**
*WQV Drawdown Calculation*

T. DABOLT
8/2/2021

**DRAWDOWN ORIFICE DESIGN**

|  |  |  |
|---|---:|---|
| D orifice = | 2.25 | inch |
| # orifices = | 1 | |
| Ks = | 13490 | |
| b = | 1.1886 | |
| $C_d$ orifice = | 0.60 | |
| Normal Pool Elevation = | 310.00 | feet |
| Volume @ Normal Pool = | 0 | cf |
| Orifice Invert = | 310.00 | feet |
| WSEL @ 1" Runoff Volume = | 311.65 | feet |

| WSEL (feet) | Vol. Stored (cf) | Orifice Flow (cfs) | Avg. Flow (cfs) | Incr. Vol. (cf) | Incr. Time (sec) |
|---|---|---|---|---|---|
| 311.65 | 24443 | 0.166 | | | |
| 311.51 | 21977 | 0.158 | 0.162 | 2466 | 15252 |
| 311.37 | 19554 | 0.150 | 0.154 | 2423 | 15753 |
| 311.23 | 17178 | 0.141 | 0.145 | 2376 | 16332 |
| 311.08 | 14853 | 0.132 | 0.137 | 2325 | 17012 |
| 310.94 | 12585 | 0.122 | 0.127 | 2268 | 17830 |
| 310.80 | 10380 | 0.112 | 0.117 | 2205 | 18842 |
| 310.66 | 8247 | 0.100 | 0.106 | 2133 | 20150 |
| 310.52 | 6199 | 0.087 | 0.093 | 2048 | 21949 |
| 310.38 | 4254 | 0.071 | 0.079 | 1945 | 24694 |
| 310.24 | 2444 | 0.050 | 0.061 | 1810 | 29867 |

| Drawdown Time = | 2.29 days |
|---|---|

By comparison, if calculated by the average head over the orifice
(assuming average head is one-third the total depth), the result would be:

|  |  |  |
|---|---:|---|
| Average driving head on orifice = | 0.518 | feet |
| Orifice composite loss coefficient = | 0.600 | |
| Cross-sectional area of siphon = | 0.028 | sf |
| Q = | 0.0957 | cfs |

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

| Drawdown Time = | 2.96 days |
|---|---|

**STORMWATER CONTROL MEASURE 'J'**
*Anti-Flotation Block Calculations*

---

### RISER ANTI-FLOTATION CALCULATION

**Input Data ==>**

*Safety Factor:*

Safety factor to use = 1.15 (recommend 1.15 or higher)

*Concrete:*

Concrete unit weight = 142.0 PCF   **Note:** NC Products lists unit wt. of manhole concrete at 142 PCF.

*Riser:*

| | |
|---|---|
| Inside height of Riser = | 5.50 feet |
| Inside length of riser = | 5.00 feet |
| Inside width of riser = | 5.00 feet |
| Wall thickness of riser = | 6.00 inches |
| Base thickness of riser = | 6.00 inches |
| Base length of riser = | 6.00 feet |
| Base width of riser = | 6.00 feet |

*Openings:*

| | |
|---|---|
| Total Orifice Area = | 2.110 SF |
| OD of barrel exiting manhole = | 44.00 inches |
| Size of drain pipe (if present) = | 6.0 inches |

*Trash Rack:*

| | |
|---|---|
| Bottom Length = | 8.40 feet |
| Bottom Width = | 8.40 feet |
| Top Length = | 2.10 feet |
| Top Width = | 2.10 feet |
| Height = | 2.00 feet |
| Trash Rack water displacement = | 61.74 CF |

**Concrete Present in Riser Structure ==>**

*Total amount of concrete:*

| | |
|---|---|
| Base of Riser = | 18.00 CF |
| Riser Walls = | 60.50 CF |

*Adjust for openings:*

| | |
|---|---|
| Opening for Orifices = | 1.06 CF |
| Opening for barrel = | 5.28 CF |
| Opening for drain pipe = | 0.10 CF |

| | |
|---|---|
| Total Concrete present, adjusted for openings = | *72.067 CF* |
| Weight of concrete present = | *10,234 lbs* |

THE POINTE
AWH20000

**STORMWATER CONTROL MEASURE 'J'**

*Anti-Flotation Block Calculations*

T. DABOLT
8/2/2021

*Amount of water displaced by Riser Structure ==>*

| | | |
|---|---:|---|
| Displacement by concrete = | 72.07 | CF |
| Displacement by open air in riser = | 137.50 | CF |
| Displacement by trash rack = | 61.74 | CF |
| Total water displaced by riser/barrel structure = | **271.31** | **CF** |
| Weight of water displaced = | **16,930** | **lbs** |

*Calculate size of base for riser assembly ==>*

| | | |
|---|---:|---|
| Length = | 9.00 | feet |
| Width = | 9.00 | feet |
| Thickness = | 18 | inches |
| Concrete Present = | 121.50 | CF |

*Check validity of base as designed ==>*

| | | |
|---|---:|---|
| Total Water Displaced = | 374.81 | CF |
| Total Concrete Present = | 193.57 | CF |
| Total Water Displaced = | 23,388 | lbs |
| Total Concrete Present = | 27,487 | lbs |
| *Actual safety factor =* | *1.18* | OK |

*Results of design ==>*

| | | |
|---|---:|---|
| Base length = | 9.00 | feet |
| Base width = | 9.00 | feet |
| Base Thickness = | 18.00 | inches |
| CY of concrete total in base = | 4.50 | CY |
| Concrete unit weight in added base >= | 142.0 | PCF |

THE POINTE
AWH20000

**STORMWATER CONTROL MEASURE 'J'**
*Anti-Flotation Block Calculations*

T. DABOLT
8/2/2021

## II. CALCULATION FOR RISER ANTI-FLOTATION STEEL

**Input Data ==>**

| | | |
|---|---|---|
| Anti-Floatation Block Length = | 9.0 | feet |
| Anti-Floatation Block Width = | 9.0 | feet |
| Anti-Floatation Block Thickness = | 18 | inches |

$A_{steel}$ to $A_{concrete}$ Ratio = 0.0020 (recommend 0.0018 or hi

**Cross-Section Calculations==>**

| | | |
|---|---|---|
| Cross-Section Area* = | 13.50 | SF |
| Minimum Steel Area Required = | 0.027 | SF |
| | **3.89** | SI |

*Note:  Assumes a "square" x-sec (L and W same)*

**Rebar Calculations ==>**

| Bar Size | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|
| Diameter (inches) | 0.500 | 0.625 | 0.750 | 0.875 | 1.000 |
| X-Sec Area (SI) | 0.196 | 0.307 | 0.442 | 0.601 | 0.785 |
| Minimum Number of Bars | 20 | 13 | 9 | 7 | 5 |

## DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

| | | | | | |
|---|---|---|---|---|---|
| Project | The Point | | | Date | 11/23/2020 |
| Project No. | AWH-20000 | | | Designer | TKD |
| Outlet ID | SCM J | | | | |

| | | |
|---|---|---|
| Flow, $Q_{10-yr}$ | 23.0 | cfs |
| Slope, S | 1.03 | % |
| Pipe Diameter, $D_o$ | 36 | inches |
| Pipe Diameter, $D_o$ | 3.0 | feet |
| Number of pipes | 1 | |
| Pipe separation | 0 | feet |
| Manning's n | 0.013 | |

**Figure 8.06.b.1**
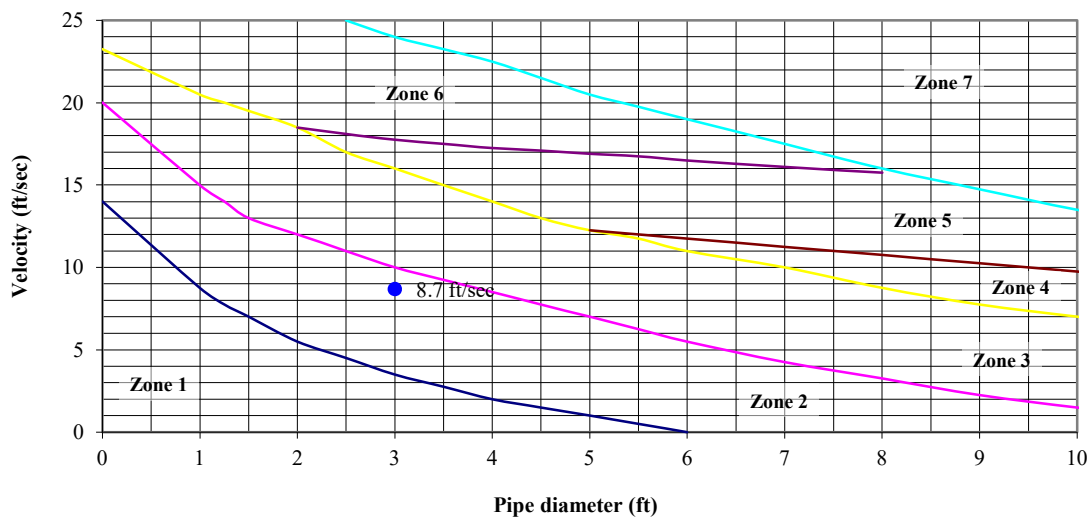


Zone from graph above = _____ 3 _____

| | | | | |
|---|---|---|---|---|
| Outlet pipe diameter | 36 in. | Length = | 24.0 ft. | |
| Outlet flowrate | 23.0 cfs | Width = | 9.0 ft. | |
| Outlet velocity | 8.7 ft/sec | Stone diameter = | 13 in. | |
| Material = | Class I | Thickness = | 22 in. | |

| Zone | Material | Diameter | Thickness | Length | Width |
|---|---|---|---|---|---|
| 1 | Class A | 3 | 9 | 4 x D(o) | 3 x D(o) |
| 2 | Class B | 6 | 22 | 6 x D(o) | 3 x D(o) |
| 3 | Class I | 13 | 22 | 8 x D(o) | 3 x D(o) |
| 4 | Class I | 13 | 22 | 8 x D(o) | 3 x D(o) |
| 5 | Class II | 23 | 27 | 10 x D(o) | 3 x D(o) |
| 6 | Class II | 23 | 27 | 10 x D(o) | 3 x D(o) |
| 7 | Special study required | | | | |

1. Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual
2. Outlet velocity based on full-flow velocity